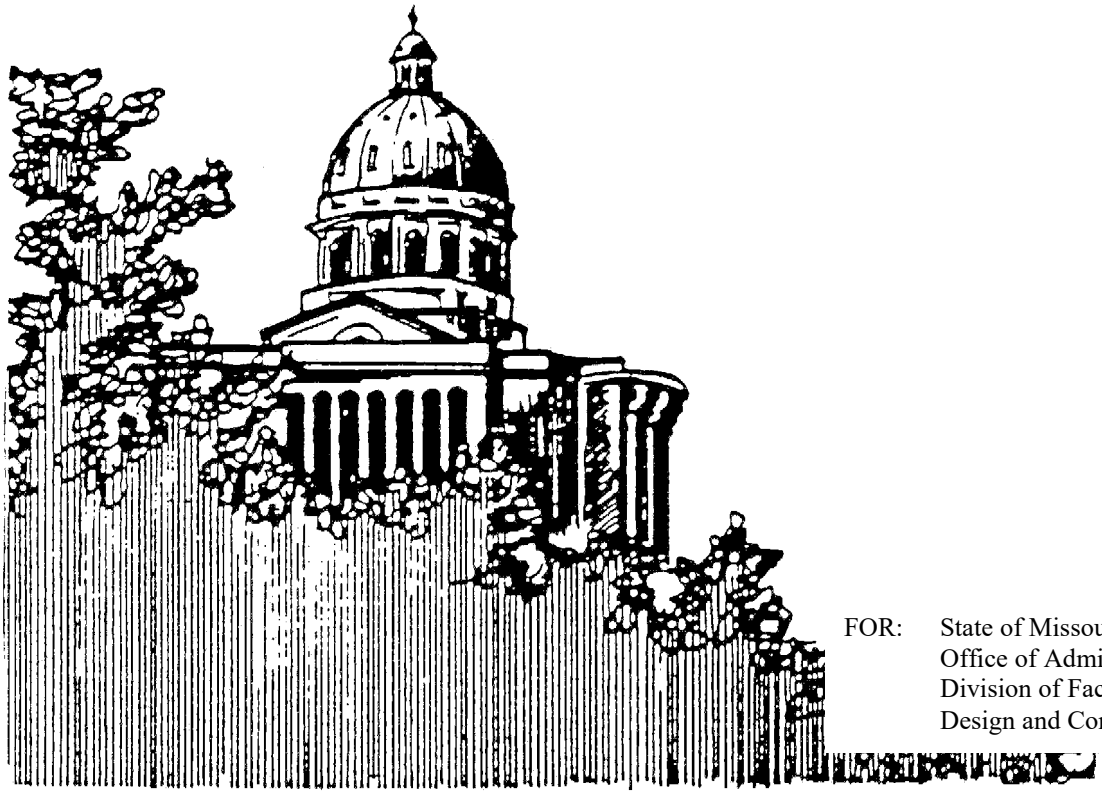
PROJECT MANUAL

30-Man Barracks
Camp Crowder Training Site
Neosho, Missouri

DESIGNED BY: GLMV Architecture, Inc.
9229 Ward Parkway, Ste 210
Kansas City, MO 64114

DATE ISSUED: 5/28/20

PROJECT NO.: T2049-01



FOR: State of Missouri
Office of Administration
Division of Facilities Management,
Design and Construction

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

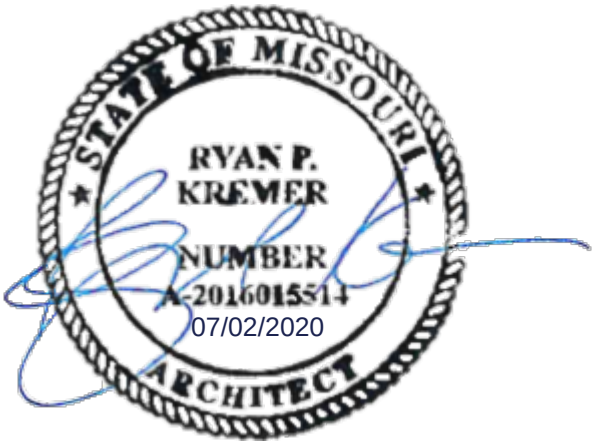
PROJECT NO.: T2049-01 Design Master Plan Facilities
Camp Crowder Training Site
30-Man Barracks
Neosho, Missouri

THE FOLLOWING DESIGN PROFESSIONALS HAVE SIGNED AND SEALED THE ORIGINAL PLANS AND SPECIFICATIONS FOR THIS PROJECT, WHICH ARE ON FILE WITH THE DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION:

GLMV Architecture, Inc.

Ryan P. Kremer, AIA

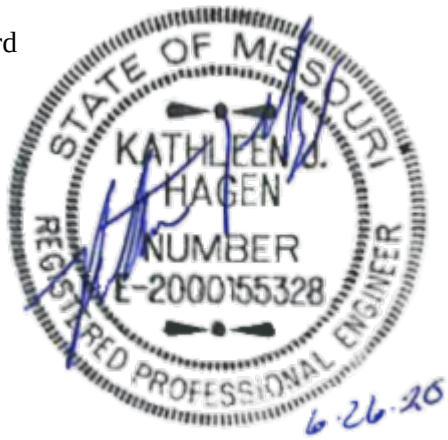
Architecture – Designer of Record



KH Engineering Group, P.A.

Kathy J. Hagen, PE

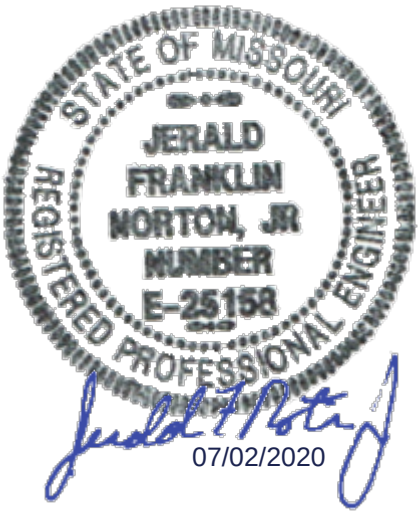
Structural Engineer – Designer of Record



Olsson Associates

Jerald Norton, PE

Civil Engineer – Designer of Record



Hoss and Brown Engineers, Inc.

Casey Steiner, PE

Mechanical, Electrical and Plumbing Engineer of Record

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SECTION 000115 – LIST OF DRAWINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Bid Form and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section provides a comprehensive list of the Drawings that comprise the Bid Documents for this Project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 LIST OF DRAWINGS

A. The following list of Drawings is a part of the Bid Documents:

	TITLE	SHEET	DATE	CADD NO.
1.	Cover Sheet & Index of Drawings	G-001	05/28/2020	T2049-01_6260_8136260014_G-001
2.	Life Safety Plan & Code Analysis	G-002	05/28/2020	T2049-01_6260_8136260014_G-002
3.	UL-Listed Assemblies	G-003	05/28/2020	T2049-01_6260_8136260014_G-003
4.	Site Plan	C-101	05/28/2020	T2049-01_6260_8136260014_C-101
5.	Grading, Drainage & EC Plan	C-102	05/28/2020	T2049-01_6260_8136260014_C-102
6.	Utility Plan	C-103	05/28/2020	T2049-01_6260_8136260014_C-103
7.	Details	C-104	05/28/2020	T2049-01_6260_8136260014_C-104
8.	General Notes	S-001	05/28/2020	T2049-01_6260_8136260014_S-001
9.	General Notes, Abbreviations, Miscellaneous	S-002	05/28/2020	T2049-01_6260_8136260014_S-002
10.	Foundation Plan	S-101	05/28/2020	T2049-01_6260_8136260014_S-101

TITLE	SHEET	DATE	CADD NO.
11. Sections	S-301	05/28/2020	T2049-01_6260_8136260014_S-301
12. Symbols, Abbreviations & Notes	A-001	05/28/2020	T2049-01_6260_8136260014_A-001
13. Typical Mounting Heights	A-002	05/28/2020	T2049-01_6260_8136260014_A-002
14. Floor & Dimension Plans	A-101	05/28/2020	T2049-01_6260_8136260014_A-101
15. Reflected Ceiling & Roof Plans	A-111	05/28/2020	T2049-01_6260_8136260014_A-111
16. Exterior Elevations & Bldg. Sections	A-201	05/28/2020	T2049-01_6260_8136260014_A-201
17. Wall Sections & Details	A-311	05/28/2020	T2049-01_6260_8136260014_A-311
18. Enlarged Floor Plans & Interior Elev.	A-401	05/28/2020	T2049-01_6260_8136260014_A-401
19. Details	A-501	05/28/2020	T2049-01_6260_8136260014_A-501
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22. Finish Schedule	I-101	05/28/2020	T2049-01_6260_8136260014_I-101
23. Signage Plan & Details	I-111	05/28/2020	T2049-01_6260_8136260014_I-111
24. Symbols Legend	MPE101	05/28/2020	T2049-01_6260_8136260014_MPE101
25. Mechanical Plan and Schedules	M-101	05/28/2020	T2049-01_6260_8136260014_M-101
26. Mechanical Details	M-401	05/28/2020	T2049-01_6260_8136260014_M-401
27. Plumbing and Fire Protection Plans	P-101	05/28/2020	T2049-01_6260_8136260014_P-101
28. Plumbing Schedules & Details	P-401	05/28/2020	T2049-01_6260_8136260014_P-401
29. Lighting, Power and Special Systems Plan	E-101	05/28/2020	T2049-01_6260_8136260014_E-101
30. Electrical Schedules	E-501	05/28/2020	T2049-01_6260_8136260014_E-401

END OF SECTION 000115

SECTION 001116 - INVITATION FOR BID

1.0 OWNER:

A. The State of Missouri
Office of Administration,
Division of Facilities Management, Design and Construction
Jefferson City, Missouri

2.0 PROJECT TITLE AND NUMBER:

A. 30-Man Barracks
Camp Crowder Training Site
Neosho, Missouri
Project No.: T2049-01

3.0 BIDS WILL BE RECEIVED:

A. Until: 1:30 PM, August 27, 2020

B. **Only electronic bids on MissouriBUYS shall be accepted: https://missouribuys.mo.gov. Bidder must be registered to bid.**

4.0 DESCRIPTION:

A. Scope: The project includes the construction of a new 30-Man Barracks building and all associated site work, exterior envelope construction, internal structural frame, interior partitions, structural reinforcement (apart from the pre-engineered design) to resist tornado-force winds for an internal storm shelter, and split-system HVAC components.

B. Estimate: $729,000 to $1,000,000

C. MBE/WBE/SDVE Goals: MBE 10%, WBE 10%, & SDVE 3%. **NOTE: Only MBE/WBE firms certified by the State of Missouri Office of Equal Opportunity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.**

D. **NOTE: Bidders are provided new Good Faith Effort (GFE) forms on MissouriBUYS.

5.0 PRE-BID MEETING:

A. Place/Time: 2:00 p.m.; August 12, 2020, Camp Crowder Training Site, HQ Bldg., 890 Ray A. Carver Avenue, Neosho, MO.

B. Access to State of Missouri property requires presentation of a photo ID by all persons

6.0 HOW TO GET PLANS & SPECIFICATIONS:

A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of $100 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, https://www.adsplanroom.net. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate. Additional bid sets or parts thereof may be obtained by any bidder at the cost of printing and shipping by request to American Document Solutions at the address shown above. **Bidder must secure at least one bid set to become a planholder.**

B. **Refunds: Return plans and specifications in unmarked condition within 15 working days of bid opening to American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433. Deposits for plans not returned within 15 working days shall be forfeited.**

C. Information for upcoming bids, including downloadable plans, specifications, Invitation for Bid, bid tabulation, award, addenda, and access to the ADS planholders list, is available on the Division of Facilities Management, Design and Construction's web site: https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans.

7.0 POINT OF CONTACT:

A. Designer: GLMV Architecture, Inc., John Potter, phone # 816-444-4200

B. Project Manager: Jeremy Newton, phone # 573-638-9500 ext. 37484

8.0 GENERAL INFORMATION:

A. The State reserves the right to reject any and all bids and to waive all informalities in bids. No bid may be withdrawn for a period of 20 working days subsequent to the specified bid opening time. The contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations and as set out in the detailed plans and specifications.

B. Bid results will be available at https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans after it is verified that at least one bid is awardable and affordable.

Very Important MissouriBUYS Instructions to Help Submit a Bid Correctly

A. The bidder shall submit his or her bid and all supporting documentation on MissouriBUYS eProcurement System. No hard copy bids shall be accepted. Go to https://missouribuys.mo.gov and register. The bidder must register before access is granted to the solicitation details and bidding is possible, however, the bidder can review a summary of the project by selecting "Bid Board" and then checking off "Open" under "Status" and "OA-FMDC-Contracts Chapter 8" under "Organization" in the boxes shown on the left margin.

B. Once registered, log in.
1. Under "Solicitation" select "View Current Solicitations." A new screen will open.
2. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8."
3. Under "Filter by Opp. No." type in the State Project Number. Select "Submit."
4. Above the dark blue bar, select "Other Active Opportunities."
5. To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information.

C. Here are simplified instructions for uploading the bid to MissouriBUYS:
1. Find the solicitation by completing Steps 1 through 4 above.
2. Select the three dots under "Actions." Select "Add New Response."
3. When the Quote box opens, give the response a title and select "OK."
4. The detailed solicitation will open. Select "Check All" for the Original Solicitation Documents, open each document, and select "Accept." If this step is not completed, a bid cannot be uploaded. Scroll to the bottom of the page and select "Add Attachments." If you do not see this command, not all documents have been opened and accepted.
5. The Supplier Attachments box will open. Select "Add Attachment" again.
6. The Upload Documents box will open. Read the instructions for uploading. Disregard the "Confidential" check box.
7. Browse and attach up to 5 files at a time. Scroll to bottom of box and select "Upload." The Supplier Attachments box will open. Repeat Steps 5 through 7 if more than 5 files are to be uploaded.
8. When the Supplier Attachments box opens again and uploading is complete, select "Done." A message should appear that the upload is successful. If it does not, go to the Bidder Response tab and select "Submit."
9. The detailed solicitation will open. At the bottom select "Close."

D. Any time a bidder wants to modify the bid, he or she will have to submit a new one. FMDC will open the last response the bidder submits. The bidder may revise and submit the bid up to the close of the solicitation (bid date and time). Be sure to allow for uploading time so that the bid is successfully uploaded prior to the 1:30 PM deadline; we can only accept the bid if it is uploaded before the deadline.

E. If you want to verify that you are uploading documents correctly, we encourage you to submit a fake bid early. Label the fake bid as such to distinguish it from the real bid. The contracts person you contact will let you know if your "bid" was received successfully. Please contact Drew Henrickson: 573-751-8128, drew.henrickson@oa.mo.gov; Kelly Copeland: 573-522-2283, kelly.copeland@oa.mo.gov., or Paul Girouard: 573-751-4797, paul.girouard@oa.mo.gov.

F. If you are experiencing login issues, please contact Web Procure Support (Proactis) at 866-889-8533 anytime from 7:00 AM to 7:00 PM Central Time, Monday through Friday. If you try using a userid or password several times that is incorrect, the system will lock you out. Web Procure Support is the only option to unlock you! If you forget your userid or password, Web Procure Support will provide a temporary userid or password. Also, if it has been a while since your last successful login and you receive an "inactive" message, contact Web Procure (Proactis). If you are having a registration issue, you may contact Cathy Holliday at 573-751-3491 or by email: cathy.holliday@oa.mo.gov.

IMPORTANT REMINDER REGARDING REQUIREMENT FOR OEO CERTIFICATION

A. SECTION 002113 – INSTRUCTIONS TO BIDDERS: Article 14.0, Section D1:

As of July 1, 2020, all MBE, WBE, and MBE/WBE contractors, subcontractors, and suppliers must be certified by the State of Missouri, Office of Equal Opportunity. No certifications from other Missouri certifying agencies will be accepted.

SECTION 002113 – INSTRUCTIONS TO BIDDERS

1.0 - SPECIAL NOTICE TO BIDDERS

A. If awarded a contract, the Bidder's employees, and the employees of all subcontractors, who perform the work on the project, will be required to undergo a fingerprint background check and obtain a State of Missouri identification badge prior to beginning work on site. The Bidder should review the information regarding this requirement in Section 013513 – Site Security and Health Requirements prior to submitting a bid.

B. The Bidder's prices shall include all city, state, and federal sales, excise, and similar taxes that may lawfully be assessed in connection with the performance of work, and the purchased of materials to be incorporated in the work. THIS PROJECT IS NOT TAX EXEMPT.

2.0 - BID DOCUMENTS

A. The number of sets obtainable by any one (1) party may be limited in accordance with available supply.

B. For the convenience of contractors, sub-contractors and suppliers, copies of construction documents are on file at the office of the Director, Division of Facilities Management, Design and Construction and on the Division's web site - https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans.

3.0 - BIDDERS' OBLIGATIONS

A. Bidders must carefully examine the entire site of the work and shall make all reasonable and necessary investigations to inform themselves thoroughly as to the facilities available as well as to all the difficulties involved in the completion of all work in accordance with the specifications and the plans. Bidders are also required to examine all maps, plans and data mentioned in the specifications. No plea of ignorance concerning observable existing conditions or difficulties that may be encountered in the execution of the work under this contract will be accepted as an excuse for any failure or omission on the part of the contractor to fulfill in every detail all of the requirements of the contract, nor accepted as a basis for any claims for extra compensation.

B. Under no circumstances will contractors give their plans and specifications to another contractor. Any bid received from a contractor whose name does not appear on the list of plan holders may be subject to rejection.

4.0 - INTERPRETATIONS

A. No bidder shall be entitled to rely on oral interpretations as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction. Every request for interpretation shall be made in writing and submitted with all supporting documents not less than five (5) working days before opening of bids. Every interpretation made to a bidder will be in the form of an addendum and will be sent as promptly as is practicable to all persons to whom plans and specifications have been issued. All such addenda shall become part of the contract documents.

B. Approval for an "acceptable substitution" issued in the form of an addendum as per Paragraph 4A above, and as per Article 3.1 of the General Conditions; ACCEPTABLE SUBSTITUTIONS shall constitute approval for use in the project of the product.

C. An "acceptable substitution" requested after the award of bid shall be approved if proven to the satisfaction of the Owner and the Designer as per Article 3.1, that the product is acceptable in design, strength, durability, usefulness, and convenience for the purpose intended. Approval of the substitution after award is at the sole discretion of the Owner.

D. A request for "Acceptable Substitutions" shall be made on the Section 006325 Substitution Request Form. The request shall be sent directly to the project Designer. A copy of said request should also be mailed to the Owner, Division of Facilities Management, Design and Construction, Post Office Box 809, Jefferson City, Missouri 65102.

5.0 - BIDS AND BIDDING PROCEDURE

A. Bidders shall submit all submission forms and accompanying documents listed in SECTION 004113 – BID FORM, Article 5.0, ATTACHMENTS TO BID by the stated time or their bid will be rejected for being non-responsive.

Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals and times when they may be due. Please check for specific project requirements on the proposal form (Section 004113). ***Not all of the following bid forms may be required to be submitted.***

Bid Submittal – due before stated date and time of bid opening (see IFB):

004113	Bid Form (all pages are always required)
004322	Unit Prices Form
004336	Proposed Subcontractors Form
004337	MBE/WBE/SDVE Compliance Evaluation Form
004338	MBE/WBE/SDVE Eligibility Determination for Joint Ventures
004339	MBE/WBE/SDVE GFE Determination
004340	SDVE Business Form
004541	Affidavit of Work Authorization

B. All bids shall be submitted without additional terms and conditions, modification or reservation on the bid forms with each space properly filled. Bids not on these forms will be rejected.

C. All bids shall be accompanied by a bid bond executed by the bidder and a duly authorized surety company, certified check, cashier's check or bank draft made payable to the Division of Facilities Management, Design and Construction, State of Missouri, in the amount indicated on the bid form, Section 004113. Failure of the contractor to submit the full amount required shall be sufficient cause to reject his bid. The bidder agrees that the proceeds of the check, draft or bond shall become the property of the State of Missouri, if for any reason the bidder withdraws his bid after closing, or if on notification of award refuses or is unable to execute tendered contract, provide an acceptable performance and payment bond, provide evidence of required insurance coverage and/or provide required copies of affirmative action plans within ten (10) working days after such tender.

D. The check or draft submitted by the successful bidder will be returned after the receipt of an acceptable performance and payment bond and execution of the formal contract. Checks or drafts of all other bidders will be returned within a reasonable time after it is determined that the bid represented by same will receive no further consideration by the State of Missouri. Bid bonds will only be returned upon request.

6.0 - SIGNING OF BIDS

A. A bid from an individual shall be signed as noted on the Bid Form.

B. A bid from a partnership or joint venture shall require only one signature of a partner, an officer of the joint venture authorized to bind the venture or an attorney-in-fact. If the bid is signed by an officer of a joint venture or an attorney-in-fact, a document evidencing the individual's authority to execute contracts should be included with the bid form.

C. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.

D. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation manually written. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual. Corporate license number shall be provided and, if a corporation organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached. In addition, for corporate proposals, the President or Vice-President should sign as the bidder. If the signator is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signator has the legal authority to bind the corporation.

E. A bid should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form should appear as shown in the Secretary of State's records.

F. The Bidder should include its corporate license number on the Bid Form and, if the corporation is organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached to the bid form.

7.0 - RECEIVING BID SUBMITTALS

A. It is the bidder's sole responsibility to assure receipt by Owner of bid submittals by the date and time specified in the Invitation for Bid. Bids received after the date and time specified shall not be considered by the Owner.

B. Bids must be submitted through the MissouriBUYS statewide eProcurement system (https://www.missouribuys.mo.gov/) in accordance with the instructions for that system. The Owner shall only accept bids submitted through MissouriBUYS. Bids received by the Owner through any other means, including hard copies, shall not be considered and will be discarded by the Owner unopened.

C. To respond to an Invitation for Bid, the Bidder must first register with MissouriBUYS by going through the MissouriBUYS Home Page (https://www.missouribuys.mo.gov/), clicking the "Register" button at the top of the page, and completing the Vendor Registration. Once registered, the Bidder accesses its account by clicking the "Login" button at the top of the MissouriBUYS Home Page. Enter your USERID and PASSWORD, which the Bidder will select. Under Solicitations, select "View Current Solicitations." A new screen will open. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8." Under "Filter by Opp. No." type in the State Project Number. Select "Submit." Above the dark blue bar, select "Other Active Opportunities." To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information. The Bidder must read and accept the Original Solicitation Documents and complete all identified requirements. The Bidder should download and save all of the Original Solicitation Documents on its computer so that the Bidder can prepare its response to these documents. The Bidder should upload its completed response to the downloaded documents as an attachment to the electronic solicitation response.

D. Step-by-step instructions for how a registered vendor responds to a solicitation electronically are provided in Section 001116 – Invitation For Bid.

E. The Bidder shall submit its bid on the forms provided by the Owner on MissouriBUYS with each space fully and properly completed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner may reject bids that are not on the Owner's forms or that do not contain all requested information.

F. No Contractor shall stipulate in his bid any conditions not contained in the specifications or standard bid form contained in the contract documents. To do so may subject the Contractor's bid to rejection.

G. The completed forms shall be without interlineations, alterations or erasures.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

A. Bidder may withdraw his bid at any time prior to scheduled closing time for receipt of bids, but no bidder may withdraw his bid for a period of twenty (20) working days after the scheduled closing time for receipt of bids.

B. The Bidder shall modify his or her original bid by submitting a revised bid on MissouriBUYS.

9.0 - AWARD OF CONTRACT

A. The Owner reserves the right to reject any and/or all bids and further to waive all informalities in bidding when deemed in the best interest of the State of Missouri.

B. The Owner reserves the right to let other contracts in connection with the work, including but not by way of limitation, contracts for the furnishing and installation of furniture, equipment, machines, appliances and other apparatus.

C. In awarding the contract the Owner may take into consideration the bidder's skill, facilities, capacity, experience, responsibility, previous work record, financial standing and the necessity of prompt and efficient completion of work herein described. Inability of any bidder to meet the requirements mentioned above may be cause for rejection of his bid. However, no contract will be awarded to any individual,

partnership or corporation, who has had a contract with the State of Missouri declared in default within the preceding twelve months.

D. Award of alternates, if any, will be made in numerical order unless all bids received are such that the order of acceptance of alternates does not affect the determination of the low bidder.

E. No bid shall be considered binding upon the Owner until the written contract has been properly executed, a satisfactory bond has been furnished, evidence of required insurance coverage, submittal of executed Section 004541, Affidavit of Work Authorization form, documentation evidencing enrollment and participation in a federal work authorization program has been received and an affirmative action plan submitted. Failure to execute and return the contract and associated documents within the prescribed period of time shall be treated, at the option of the Owner, as a breach of bidder's obligation and the Owner shall be under no further obligation to bidder.

F. If the successful bidder is doing business in the State of Missouri under a fictitious name, he shall furnish to Owner, attached to the Bid Form, a properly certified copy of the certificate of Registration of Fictitious Name from the State of Missouri, and such certificate shall remain on file with the Owner.

G. Any successful bidder which is a corporation organized in a state other than Missouri shall furnish to the Owner, attached to the Bid Form, a properly certified copy of its current Certificate of Authority to do business in the State of Missouri, such certificate to remain on file with the Owner. No contract will be awarded by the Owner unless such certificate is furnished by the bidder.

H. Any successful bidder which is a corporation organized in the State of Missouri shall furnish at its own cost to the Owner, if requested, a Certificate of Good Standing issued by the Secretary of State, such certificate to remain on file with the Owner.

I. Transient employers subject to Sections 285.230 and 285.234, RSMo, (out-of-state employers who temporarily transact any business in the State of Missouri) may be required to file a bond with the Missouri Department of Revenue. No contract will be awarded by the Owner unless the successful bidder certifies that he has complied with all applicable provisions of Section 285.230-234.

J. Sections 285.525 and 285.530, RSMo, require business entities to enroll and participate in a federal work authorization program in order to be eligible to receive award of any state contract in excess of $5,000. Bidders should submit with their bid an Affidavit of Work Authorization (Section 004541) along with appropriate documentation evidencing such enrollment and participation. Section-004541, Affidavit of Work Authorization is located on the MissouriBUYS solicitation for this project. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding a E-Verify is located at https://www.uscis.gov/e-verify/. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

10.0 - CONTRACT SECURITY

A. The successful bidder shall furnish a performance/payment bond as set forth in General Conditions Article 6.1 on a condition prior to the State executing the contract and issuing a notice to proceed.

11.0 - LIST OF SUBCONTRACTORS

A. If required by "Section 004113 – Bid Form," each bidder must submit as part of their bid a list of subcontractors to be used in performing the work (Section 004336). The list must specify the name of the single designated subcontractor, for each category of work listed in "Section 004336 - Proposed Subcontractors Form." If work within a category will be performed by more than one subcontractor, the bidder must provide the name of each subcontractor and specify the exact portion of the work to be done by each. Failure to list the Bidder's firm, or a subcontractor for each category of work identified on the Bid Form or the listing of more than one subcontractor for any category without designating the portion of work to be performed by each shall be cause for rejection of the bid. If the bidder intends to perform any of the designated subcontract work with the use of his own employees, the bidder shall make that fact clear, by listing his own firm for the subject category. **If any category of work is left vacant, the bid shall be rejected.**

12.0 - WORKING DAYS

A. Contract duration time is stated in working days and will use the following definition in determining the actual calendar date for contract completion:

1. Working days are defined as all calendar days except Saturdays, Sundays and the following State of Missouri observed holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday, Truman Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day.

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

A. By signing the bid form and submitting a bid on this project, the Bidder certifies that it will use American and Missouri products as set forth in Article 1.7 of the General Conditions. Bidders are advised to review those requirements carefully prior to bidding.

B. A preference shall be given to Missouri firms, corporations or individuals, or firms, corporations or individuals that maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less.

C. Pursuant to Section 34.076, RSMo, a contractor or Bidder domiciled outside the boundaries of the State of Missouri shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor or Bidder domiciled in Missouri as would be required for such a Missouri domiciled contractor or Bidder to succeed over the bidding contractor or Bidder domiciled outside Missouri on a like contract or bid being let in the person's domiciliary state and, further, the contractor or Bidder domiciled outside the boundaries of Missouri shall be required to submit an audited financial statement as would be required of a Missouri domiciled contractor or Bidder on a like contract or bid being let in the domiciliary state of that contractor or Bidder.

14.0 - MBE/WBE/SDVE INSTRUCTIONS

A. Definitions:

1. "MBE" means a Minority Business Enterprise.

2. "MINORITY" has the same meaning as set forth in 1 C.S.R. 10-17.010.

3. "MINORITY BUSINESS ENTERPRISE" has the same meaning as set forth in section 37.020, RSMo.

4. "WBE" means a Women's Business Enterprise.

5. "WOMEN'S BUSINESS ENTERPRISE" has the same meaning as set forth in section 37.020, RSMo.

6. "SDVE" means a Service-Disabled Veterans Enterprise.

7. "SERVICE-DISABLED VETERAN" has the same meaning as set forth in section 34.074, RSMo.

8. "SERVICE-DISABLED VETERAN ENTERPRISE" has the same meaning as "Service-Disabled Veteran Business" set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

1. For all bids greater than $100,000, the Bidder shall obtain MBE, WBE and SDVE participation in an amount equal to or greater than the percentage goals set forth in the Invitation for Bid and the Bid Form, unless the Bidder is granted a Good Faith Effort waiver by the Director of the Division, as set forth below. If the Bidder does not meet the MBE, WBE and SDVE goals, or make a good faith effort to do so, the Bidder shall be non-responsive, and its bid shall be rejected.

2. The Bidder should submit with its bid all of the information requested in the MBE/WBE/SDVE Compliance Evaluation Form for every MBE, WBE, or SDVE subcontractor or material supplier the Bidder intends to use for the contract work. The Bidder is required to submit all appropriate

MBE/WBE/SDVE documentation before the stated time and date set forth in the Invitation for Bid. If the Bidder fails to provide such information by the specified date and time, the Owner shall reject the bid.

3. The Director reserves the right to request additional information from a Bidder to clarify the Bidder's proposed MBE, WBE, and/or SDVE participation. The Bidder shall submit the clarifying information requested by the Owner within two (2) Working Days of receiving the request for clarification.

4. Pursuant to section 34.074, RSMo, a Bidder that is a SDVE doing business as Missouri firm, corporation, or individual, or that maintains a Missouri office or place of business, shall receive a three-point bonus preference in the contract award evaluation process. The bonus preference will be calculated and applied by reducing the bid amount of the eligible SDVE by three percent of the apparent low responsive bidder's bid. Based on this calculation, if the eligible SDVE's evaluation is less than the apparent low responsive bidder's bid, the eligible SDVE's bid becomes the apparent low responsive bid. This reduction is for evaluation purposes only, and will have no impact on the actual amount(s) of the bid or the amount(s) of any contract awarded. In order to be eligible for the SDVE preference, the Bidder must complete and submit with its bid the Missouri Service Disabled Veteran Business Form, and any information required by the form. The form is available on the MissouriBUYS solicitation for this project.

C. Computation of MBE/WBE/SDVE Goal Participation:

1. A Bidder who is a MBE, WBE, or SDVE may count 100% of the contract towards the MBE, WBE or SDVE goal, less any amounts awarded to another MBE, WBE or SDVE. (NOTE: A MBE firm that bids as general contractor must obtain WBE and SDVE participation; a WBE firm that bids as a general contractor must obtain MBE and SDVE participation; and a SDVE firm that bids as general contractor must obtain MBE and WBE participation.) In order for the remaining contract amount to be counted towards the MBE, WBE or SDVE goal, the Bidder must complete the MBE/WBE/SDVE Compliance Evaluation Form (Section 004337) identifying itself as an MBE, WBE or SDVE.

2. The total dollar value of the work granted to a certified MBE, WBE or SDVE by the Bidder shall be counted towards the applicable goal.

3. Expenditures for materials and supplies obtained from a certified MBE, WBE, or SDVE supplier or manufacturer may be counted towards the MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.

4. The total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier may be counted towards a Bidder's MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE properly assumes the actual and contractual responsibility for the work.

5. The total dollar value of work granted to a certified joint venture equal to the percentage of the ownership and control of the MBE, WBE, or SDVE partner in the joint venture may be counted towards the MBE/WBE/SDVE goals.

6. Only expenditures to a MBE, WBE, or SDVE that performs a commercially useful function in the work may be counted towards the MBE, WBE and SDVE goals. A MBE, WBE, or SDVE performs a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by actually performing, managing and supervising the work or providing supplies or manufactured materials.

D. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Administration, Division of Purchasing and Material Management or by the Department of Veterans Affairs.

2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)'s online MBE/WBE directory (https://apps1.mo.gov/oeo/). The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Division of Purchasing and Materials Management's online SDVE directory (http://oa.mo.gov/purchasing/vendor-information/missouri-service-disabled-veteran-business-enterprise-sdve-information) or the Department of Veterans Affairs' directory (https://www.vip.vetbiz.gov/).

3. Additional information, clarifications, etc., regarding the listings in the directories may be obtained by calling the Division at (573)751-3339 and asking to speak to the Contract Specialist of record as shown in the Supplementary Conditions (Section 007300).

E. Waiver of MBE/WBE/SDVE Participation:

1. If a Bidder has made a good faith effort to secure the required MBE, WBE and/or SDVE participation and has failed, the Bidder shall submit with its bid the information requested in MBE/WBE/SDVE Good Faith Effort (GFE) Determination form. The GFE forms are located on the MissouriBUYS solicitation for this project. The Director will determine if the Bidder made a good faith effort to meet the applicable goals. If the Director determines that the Bidder did not make a good faith effort, the bid shall be rejected as being nonresponsive to the bid requirements. Bidders who demonstrate that they have made a good faith effort to include MBE, WBE, and/or SDVE participation will be determined to be responsive to the applicable participation goals, regardless of the percent of actual participation obtained, if the bid is otherwise acceptable.

2. In determining whether a Bidder has made a good faith effort to obtain MBE, WBE and/or SDVE participation, the Director may evaluate the factors set forth in 1 CSR 30-5.010(6)(C) and the following:

   a. The amount of actual participation obtained;

   b. How and when the Bidder contacted potential MBE, WBE, and SDVE subcontractors and suppliers;

   c. The documentation provided by the Bidder to support its contacts, including whether the Bidder provided the names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;

   d. If project information, including plans and specifications, were provided to MBE/WBE/SDVE subcontractors;

   e. Whether the Bidder made any attempts to follow-up with MBE, WBE or SDVE firms prior to bid;

   f. Amount of bids received from any of the subcontractors and/or suppliers that the Bidder contacted;

   g. The Bidder's stated reasons for rejecting any bids;

3. If no bidder has obtained any participation in a particular category (MBE/WBE/SDVE) or made a good faith effort to do so, the Director may waive that goal rather than rebid.

F. Contractor MBE/WBE/SDVE Obligations

1. If awarded a contract, the Bidder will be contractually required to subcontract with or obtain materials from the MBE, WBE, and SDVE firms listed in its bid, in amounts equal to or greater than the dollar amount bid, unless the amount is modified in writing by the Owner.

2. If the Contractor fails to meet or maintain the participation requirements contained in the Contractor's bid, the Contractor must satisfactorily explain to the Director why it cannot comply

with the requirement and why failing meeting the requirement was beyond the Contractor's control. If the Director finds the Contractor's explanation unsatisfactory, the Director may take any appropriate action including, but not limited to:

a. Declaring the Contractor ineligible to participate in any contracts with the Division for up to twelve (12) months (suspension); and/or

b. Declaring the Contractor be non-responsive to the Invitation for Bid, or in breach of contract and rejecting the bid or terminating the contract.

3. If the Contractor replaces an MBE, WBE, or SDVE during the course of this contract, the Contractor shall replace it with another MBE, WBE, or SDVE or make a good faith effort to do so. All MBE, WBE and SDVE substitutions must be approved by the Director.

4. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. At a minimum, the Contractor shall report the dollar-value of work completed by each MBE, WBE, or SDVE during the preceding month and the cumulative total of work completed by each MBE, WBE or SDVE to date with each monthly application for payment. The Contractor shall also make a final report, which shall include the total dollar-value of work completed by each MBE, WBE, and SDVE during the entire contract.

STATE OF MISSOURI
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
MBE/WBE/SDVE DIRECTORY

The MBE/WBE Directory for goods and services is maintained by the Office of Equal Opportunity (OEO). The current Directory can be accessed at the following web address:

https://apps1.mo.gov/MWBCertifiedFirms/

Please note that you may search by MBE, WBE, or both as well as by region, location of the business by city or state, as well as by commodity or service.

The SERVICE DISABLED VETERAN ENTERPRISE (SDVE) Directory (s) may be accessed at the following web addresses:

https://oa.mo.gov/sites/default/files/sdvelisting.pdf

https://www.vip.vetbiz.va.gov

State of Missouri
Construction Contract

THIS AGREEMENT, made (DATE) by and between:

Contractor Name and Address

hereinafter called the "Contractor,"

and the **State of Missouri**, hereinafter called the **"Owner"**, represented by the Office of Administration, Division of Facilities Management, Design and Construction, on behalf of the **Department of Public Safety, Missouri National Guard.**

WITNESSETH, that the Contractor and the Owner, for the consideration stated herein agree as follows:

ARTICLE 1. STATEMENT OF WORK

The Contractor shall furnish all labor and materials and perform all work required for furnishing and installing all labor, materials, equipment and transportation and everything necessarily inferred from the general nature and tendency of the plans and specifications for the proper execution of the work for:

Project Name:	**Construct New 30-Man Barracks** **Camp Crowder Training Site** **Neosho, Missouri**
Project Number:	**T2049-01**

in strict accordance with the Contract Documents as enumerated in Article 7, all of which are made a part hereof.

ARTICLE 2. TIME OF COMPLETION

The contract performance time is **160** working days from the transmittal date of this agreement. The contract completion date is **MONTH, DAY, YEAR**. This time includes ten (10) working days for the Contractor to receive, sign and return the contract form along with required bonding and insurance certificates. Failure of the Contractor to provide correct bonding and insurance within the ten (10) working days shall not be grounds for a time extension. Receipt of proper bonding and insurance is a condition precedent to the formation of the contract and if not timely received, may result in forfeiture of the Contractor's bid security. Work may not commence until the Owner issues a written Notice to Proceed and must commence within seven (7) working days thereafter.

ARTICLE 3. LIQUIDATED DAMAGES

Whenever time is mentioned in this contract, time shall be and is of the essence of this contract. The Owner would suffer a loss should the Contractor fail to have the work embraced in this contract fully completed on or before the time above specified. THEREFORE, the parties hereto realize in order to adjust satisfactorily the damages on account of such failure that it might be impossible to compute accurately or estimate the amount of such loss or damages which the Owner would sustain by reason of failure to complete fully said work within the time required by this contract. The Contractor hereby covenants and agrees to pay the Owner, as and for **liquidated damages, the sum of $1,000** per day for each and every day, Sunday and legal holidays excepted, during which the work remains incomplete and unfinished. Any sum which may be due the Owner for such damages shall be deducted and retained by the Owner from any balance which may be due the Contractor when said work shall have been finished and accepted. But such provisions shall not release the Bond of the Contractor from liability according to its terms. In case of failure to complete, the Owner will be under no obligation to show or prove any actual or specific loss or damage.

ARTICLE 4. CONTRACT SUM

The Owner shall pay the Contractor for the prompt, faithful and efficient performance of the conditions and undertakings of this contract, subject to additions, and deductions as provided herein, in current funds the sum of:

Base Bid: $

The Owner accepts the following Alternate Bids:

Alternate One: $

TOTAL CONTRACT AMOUNT: ($CONTRACT AMOUNT)

UNIT PRICES: The Owner accepts the following Unit Prices: SEE ATTACHMENT A (one page)

For changing specified quantities of work from those indicated by the contract drawings and specifications, upon written instructions of Owner, the following unit prices shall prevail. The unit prices include all labor, overhead and profit, materials, equipment, appliances, bailing, shoring, shoring removal, etc., to cover the finished work of the several kinds of work called for. Only a single unit price shall be given and it shall apply for either MORE or LESS work than that shown on the drawings and called for in the specifications or included in the Base Bid. In the event of more or less units than so indicated or included, change orders may be issued for the increased or decreased amount.

ARTICLE 5. PREVAILING WAGE RATE

It is understood and agreed by and between the parties that not less than the prevailing hourly rate of wages shall be paid for work of a similar character in the locality in which the work is performed, and not less than the prevailing hourly rate of wages for legal holiday and overtime work in the locality in which the work is performed, both as determined by the Department of Labor and Industrial Relations or as determined by the court on appeal, to all workmen employed by or on behalf of the Contractor or any subcontractor, exclusive of maintenance work. Only such workmen as are directly employed by the Contractor or his subcontractors, in actual construction work on the site shall be deemed to be employed.

When the hauling of materials or equipment includes some phase of the construction other than the mere transportation to the site of the construction, workmen engaged in this dual capacity shall be deemed to be employed directly on the project and entitled to the prevailing wage.

ARTICLE 6. MINORITY/WOMEN/SERVICE DISABLED VETERAN BUSINESS ENTERPRISE PARTICIPATION

The Contractor has been granted a waiver of the 10% MBE and 10% WBE and 3% SDVE participation goals. The Contractor agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows: (OR)

The Contractor has met the MBE/WBE/SDVE participation goals and agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows:

MBE/WBE/SDVE Firm: Subcontract Amt:$
MBE/WBE/SDVE Firm: Subcontract Amt:$
MBE/WBE/SDVE Firm: Subcontract Amt:$
Total $

MBE/WBE/SDVE assignments identified above shall not be changed without a Contract Change signed by the Owner.

The Director of the Division of Facilities Management, Design and Construction or his Designee shall be the final authority to resolve disputes and disagreements between the Contractor and the MBE/WBE/SDVE firms listed above when such disputes impact the subcontract amounts shown above.

ARTICLE 7. CONTRACT DOCUMENTS

Contract documents shall consist of the following component parts:

1. Division 0, with executed forms
2. Division 1
3. Executed Construction Contract Form
4. The Drawings
5. The Technical Specifications
6. Addenda
7. Contractor's Proposal as accepted by the Owner

By signature below, the parties hereby execute this contract document.

APPROVED:

_____	_____
Mark Hill, P.E., Director Division of Facilities Management, Design and Construction	Contractor's Authorized Signature

DELETE IF PRIVATE OR PARTNERSHIP

I, Corporate Secretary, certify that I am Secretary of the corporation named above and that (CONTRACTOR NAME), who signed said contract on behalf of the corporation, was then (TITLE) of said corporation and that said contract was duly signed for and in behalf of the corporation by authority of its governing body, and is within the scope of its corporate powers.

_____

Corporate Secretary

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

AFFIDAVIT FOR AFFIRMATIVE ACTION

PROJECT NUMBER

NAME

First being duly sworn on oath states: that

he/she is the ☐ sole proprietor ☐ partner ☐ officer or ☐ manager or managing member of

NAME

a ☐ sole proprietorship ☐ partnership

☐ limited liability company (LLC)

or ☐ corporation, and as such, said proprietor, partner, or officer is duly authorized to make this

affidavit on behalf of said sole proprietorship, partnership, or corporation; that under the contract known as

PROJECT TITLE

Less than 50 persons in the aggregate will be employed and therefore, the applicable Affirmative Action

requirements as set forth in Article 1.4 of the General Conditions of the State of Missouri have been met.

PRINT NAME & SIGNATURE	DATE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER SEAL	STATE OF	COUNTY (OR CITY OF ST. LOUIS)	**USE RUBBER STAMP IN CLEAR AREA BELOW**
	SUBSCRIBED AND SWORN BEFORE ME, THIS DAY OF YEAR		
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES	
	NOTARY PUBLIC NAME (TYPED OR PRINTED)		

MO 300-1401 (05/18) FILE/Construction Contract

Bond No._____

SECTION 006113 - PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS, THAT we _____

as principal, and _____

_____as Surety, are held and firmly bound unto the

STATE OF MISSOURI. in the sum of _____ Dollars ($)

for payment whereof the Principal and Surety bind themselves, their heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

WHEREAS, the Principal has, by means of a written agreement dated the _____

day of_____, 20_____, enter into a contract with the State of Missouri for

_____

_____

_____

(Insert Project Title and Number)

NOW, THEREFORE, if the Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the State of Missouri, with or without notice to the Surety and during the life of any guaranty required under the contract; and shall also faithfully perform and fulfill all undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made with or without notice to the Surety; and shall also promptly make payment for materials incorporated, consumed or used in connection with the work set forth in the contract referred to above, and all insurance premiums, both compensation and all other kinds of insurance, on said work, and for all labor performed on such work, whether by subcontractor or otherwise, at not less than the prevailing hourly rate of wages for work of a similar character (exclusive of maintenance work) in the locality in which the work is performed and not less than the prevailing hourly rate of wages for legal holiday and overtime work (exclusive of maintenance work) in the locality in which the work is performed both as determined by the Department of Labor and Industrial Relations or determined by the Court of Appeal, as provided for in said contract and in any and all duly authorized modifications of said contract that may be hereafter made, with or without notice to the Surety, then, this obligation shall be void and of no effect, but it is expressly understood that if the Principal should make default in or should fail to strictly, faithfully and efficiently do, perform and comply with any or more of the covenants, agreements, stipulations, conditions, requirements or undertakings, as specified in or by the terms of said contract, and with the time therein named, then this obligation shall be valid and binding upon each of the parties hereto and this bond shall remain in full force and effect; and the same may be sued on at the instance of any material man, laborer, mechanic, subcontractor, individual, or otherwise to whom such payment is due, in the name of the State of Missouri, to the use of any such person.

AND, IT IS FURTHER specifically provided that any modifications which may hereinafter be made in the terms of the contract or in the work to be done under it or the giving by the Owner of any extension of the time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal to the other, shall not in any way release the Principal and the Surety, or either or any of them, their heirs, executors, administrators and successors, from their liability hereunder, notice to the Surety of any such extension, modifications or forbearance being hereby waived.

IN WITNESS WHEREOF, the above bounden parties have executed the within instrument this _____ day of _____, 20 ____.

AS APPLICABLE:

AN INDIVIDUAL

Name: _____

Signature: _____

A PARTNERSHIP

Name of Partner: _____

Signature of Partner: _____

Name of Partner: _____

Signature of Partner: _____

CORPORATION

Firm Name: _____

Signature of President: _____

SURETY

Surety Name: _____

Attorney-in-Fact: _____

Address of Attorney-in-Fact: _____

_____

Telephone Number of Attorney-in-Fact: _____

Signature Attorney-in-Fact: _____

NOTE: Surety shall attach Power of Attorney

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

PRODUCT SUBSTITUTION REQUEST

PROJECT NUMBER

PROJECT TITLE AND LOCATION

CHECK APPROPRIATE BOX

☐ SUBSTITUTION PRIOR TO BID OPENING
(Minimum of (5) working days prior to receipt of Bids as per Article 4 – Instructions to Bidders)

☐ SUBSTITUTION FOLLOWING AWARD
(Maximum of (20) working days from Notice to Proceed as per Article 3 – General Conditions)

FROM: BIDDER/CONTRACTOR (PRINT COMPANY NAME)

TO: ARCHITECT/ENGINEER (PRINT COMPANY NAME)

Bidder/Contractor hereby requests acceptance of the following product or systems as a substitution in accordance with provisions of Division One of the Bidding Documents:

SPECIFIED PRODUCT OR SYSTEM

SPECIFICATION SECTION NO.

SUPPORTING DATA

☐ Product data for proposed substitution is attached (include description of product, standards, performance, and test data)

☐ Sample ☐ Sample will be sent, if requested

QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION REQUEST
NAME, BRAND		
CATALOG NO.		
MANUFACTURER		
VENDOR		

PREVIOUS INSTALLATIONS

PROJECT	ARCHITECT/ENGINEER	
LOCATION		DATE INSTALLED

SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT

REASON FOR SUBSTITUTION

_____

_____

_____

_____

_____

_____

DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?

☐ YES ☐ NO

IF YES, EXPLAIN _____

_____

_____

_____

_____

_____

SUBSTITUTION REQUIRES DIMENSIONAL REVISION OR REDESIGN OF STRUCTURE OR A/E WORK

☐ YES ☐ NO

BIDDER'S/CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:

We have investigated the proposed substitution. We believe that it is equal or superior in all respects to specified product, except as stated above; that it will provide the same Warranty as specified product; that we have included complete implications of the substitution; that we will pay redesign and other costs caused by the substitution which subsequently become apparent; and that we will pay costs to modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning as a result of the substitution.

BIDDER/CONTRACTOR	DATE

REVIEW AND ACTION

☐ Resubmit Substitution Request with the following additional information:

_____

☐ Substitution is accepted.

☐ Substitution is accepted with the following comments:

_____

☐ Substitution is not accepted.

ARCHITECT/ENGINEER	DATE

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

FINAL RECEIPT OF PAYMENT AND RELEASE

PROJECT NUMBER

KNOW ALL MEN BY THESE PRESENT THAT: hereinafter called "Subcontractor" who heretofore entered into an agreement with hereinafter called "Contractor", for the performance of work and/or furnishing of material for the construction of the project entitled

(PROJECT TITLE, PROJECT LOCATION, AND PROJECT NUMBER)

at

(ADDRESS OF PROJECT)

for the State of Missouri (Owner) which said subcontract is by this reference incorporated herein, in consideration of such final payment by Contractor.

DOES HEREBY:

1. ACKNOWLEDGE that they have been **PAID IN FULL** all sums due for work and materials contracted or done by their Subcontractors, Material Vendors, Equipment and Fixture Suppliers, Agents and Employees, or otherwise in the performance of the Work called for by the aforesaid Contract and all modifications or extras or additions thereto, for the construction of said project or otherwise.
2. RELEASE and fully, finally, and forever discharge the Owner from any and all suits, actions, claims, and demands for payment for work performed or materials supplied by Subcontractor in accordance with the requirements of the above referenced Contract.
1. REPRESENT that all of their Employees, Subcontractors, Material Vendors, Equipment and Fixture Suppliers, and everyone else has been **paid in full** all sums due them, or any of them, in connection with performance of said Work, or anything done or omitted by them, or any of them in connection with the construction of said improvements, or otherwise.

DATED this day of , 20 .

NAME OF SUBCONTRACTOR

BY (TYPED OR PRINTED NAME)

SIGNATURE

TITLE

ORIGINAL: FILE/Closeout Documents

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

MBE/WBE/SDVE PROGRESS REPORT

SUBMIT WITH **ALL** INVOICES: (PLEASE CHECK APPROPRIATE BOX BELOW)

☐CONSULTANT ☐CONSTRUCTION

INVOICE NO.	PROJECT NUMBER
CHECK IF FINAL ☐**FINAL**	DATE

PROJECT TITLE

PROJECT LOCATION

FIRM

TOTAL CONTRACT AMOUNT

$

THE PERCENTAGE AND DOLLAR AMOUNT OF THIS PROJECT THAT ARE TO BE MBE/WBE/SDVE AS INDICATED IN THE ORIGINAL CONTRACT: **%** and **$** **.**

CHECK MBE WBE SDVE	ITEM OF WORK	TOTAL AMOUNT OF SUBCONTRACT	$ AMOUNT & % COMPLETE (PAID-TO-DATE)	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER NAME, ADDRESS, CONTACT, AND PHONE NUMBER
MBE ☐ WBE ☐ SDVE☐		$	$ %	- -
MBE ☐ WBE ☐ SDVE☐		$	$ %	- -
MBE ☐ WBE ☐ SDVE☐		$	$ %	- -
MBE ☐ WBE ☐ SDVE☐		$	$ %	- -
MBE ☐ WBE ☐ SDVE☐		$	$ %	- -

ORIGINAL: Attach to ALL Progress and Final Payments

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT – COMPLIANCE WITH PREVAILING WAGE LAW

PROJECT NUMBER

Before me, the undersigned Notary Public, in and for the County of _____

State of _____ personally came and appeared _____
(NAME)

_____ of the _____
(POSITION) (NAME OF THE COMPANY)

(a corporation) (a partnership) (a proprietorship) and after being duly sworn did depose and say that all provisions and requirements set out in Chapter 290, Sections 290.210 through and including 290.340, Missouri Revised Statutes, pertaining to the payment of wages to workmen employed on public works project have been fully satisfied and there has been no exception to the full and completed compliance with said provisions and requirements and with Wage Determination No: _____ issued by the Department of Labor and Industrial Relations, State of Missouri on the _____ day of _____ 20 __ in carrying out the contract and working in connection with _____
(NAME OF PROJECT)

Located at _____ in _____ County
(NAME OF THE INSTITUTION)

Missouri, and completed on the _____ day of _____ 20 __

SIGNATURE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER OR BLACK INK RUBBER STAMP SEAL	STATE		COUNTY (OR CITY OF ST. LOUIS)
	SUBSCRIBED AND SWORN BEFORE ME, THIS DAY OF YEAR		**USE RUBBER STAMP IN CLEAR AREA BELOW**
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES	
	NOTARY PUBLIC NAME (TYPED OR PRINTED)		

FILE: Closeout Documents

GENERAL CONDITIONS

INDEX

ARTICLE:

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1.1. Definitions

1.2. Drawings and Specifications

1.3. Compliance with Laws, Permits, Regulations and Inspections

1.4. Nondiscrimination in Employment

1.5. Anti-Kickback

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1.7. Preference for American and Missouri Products and Services

1.8. Communications

1.9. Separate Contracts and Cooperation

1.10. Assignment of Contract

1.11. Indemnification

1.12. Disputes and Disagreements

2. Owner/Designer Responsibilities

3. Contractor Responsibilities

3.1. Acceptable Substitutions

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7.2. For Cause

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SECTION 007213 - GENERAL CONDITIONS

A. These General Conditions apply to each section of these specifications. The Contractor is subject to the provisions contained herein.

B. The General Conditions are intended to define the relationship of the Owner, the Designer and the Contractor thereby establishing certain rules and provisions governing the operation and performance of the work so that the work may be performed in a safe, orderly, expeditious and workmanlike manner.

ARTICLE 1 – GENERAL PROVISIONS

ARTICLE 1.1 - DEFINITIONS

A. As used in these contract documents, the following terms shall have the meanings and refer to the parties designated in these definitions.

1. **"COMMISSIONER":** The Commissioner of the Office of Administration.
2. **"CONSTRUCTION DOCUMENTS":** The "Construction Documents" shall consist of the Project Manual, Drawings and Addenda.
3. **"CONSTRUCTION REPRESENTATIVE:"** Whenever the term "Construction Representative" is used, it shall mean the Owner's Representative at the work site.
4. **"CONTRACTOR"**: Party or parties who have entered into a contract with the Owner to furnish work under these specifications and drawings.
5. **"DESIGNER"**: When the term "Designer" is used herein, it shall refer to the Architect, Engineer, or Consultant of Record specified and defined in Paragraph 2.0 of the Supplemental Conditions, or his duly authorized representative. The Designer may be either a consultant or state employee.
6. **"DIRECTOR"**: Whenever the term "Director" is used, it shall mean the Director of the Division of Facilities Management, Design and Construction or his Designee, representing the Office of Administration, State of Missouri. The Director is the agent of the Owner.
7. **"DIVISION":** Shall mean the Division of Facilities Management, Design and Construction, State of Missouri.
8. **"INCIDENTAL JOB BURDENS":** Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.
9. **"JOINT VENTURE"**: An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.
10. **"OWNER"**: Whenever the term "Owner" is used, it shall mean the State of Missouri.
11. **"PROJECT"**: Wherever the term "Project" is used, it shall mean the work required to be completed by the construction contract.
12. **"PROJECT MANUAL"**: The "Project Manual" shall consist of Introductory Information, Invitation for Bid, Instructions to Bidders, Bid Documents, Additional Information, Standard Forms, General Conditions, Supplemental General Conditions, General Requirements and Technical Specifications.
13. **"SUBCONTRACTOR"**: Party or parties who contract under, or for the performance of part or this entire Contract between the Owner and Contractor. The subcontract may or may not be direct with the Contractor.
14. **"WORK"**: Labor, material, supplies, plant and equipment required to perform and complete the service agreed to by the Contractor in a safe, expeditious, orderly and workmanlike manner so that the project shall be complete and finished in the best manner known to each respective trade.
15. "**WORKING DAYS**": are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day (observed), Thanksgiving Day, Christmas Day.

ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

A. In case of discrepancy between drawings and specifications, specifications shall govern. Should discrepancies in architectural drawings, structural drawings and mechanical drawings occur, architectural drawings shall govern and, in case of

conflict between structural and mechanical drawings, structural drawings shall govern.

B. Specifications are separated into titled divisions for convenience of reference only and to facilitate letting of contracts and subcontracts. The Contractor is responsible for establishing the scope of work for subcontractors, which may cross titled divisions. Neither the Owner nor Designer will establish limits and jurisdiction of subcontracts.

C. Figured dimensions take precedence over scaled measurements and details over smaller scale general drawings. In the event of conflict between any of the documents contained within the contract, the documents shall take precedence and be controlling in the following sequence: addenda, supplementary general conditions, general conditions, division 1 specifications, technical division specifications, drawings, bid form and instructions to bidders.

D. Anything shown on drawings and not mentioned in these specifications or vice versa, as well as any incidental work which is obviously necessary to complete the project within the limits established by the drawings and specifications, although not shown on or described therein, shall be performed by the Contractor at no additional cost as a part of his contract.

E. Upon encountering conditions differing materially from those indicated in the contract documents, the Contractor shall promptly notify the Designer and Construction Representative in writing before such conditions are disturbed. The Designer shall promptly investigate said conditions and report to the Owner, with a recommended course of action**.** If conditions do materially differ and cause an increase or decrease in contract cost or time required for completion of any portion of the work, a contract change will be initiated as outlined in Article 4 of these General Conditions.

E. Only work included in the contract documents is authorized, and the Contractor shall do no work other than that described therein or in accordance with appropriately authorized and approved contract changes.

ARTICLE 1.3 - COMPLIANCE WITH LAWS, PERMITS, REGULATIONS AND INSPECTIONS

A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on <u>property not belonging</u> to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all <u>applicable</u> laws, ordinances, rules and regulations that pertain to the work of this contract.

B. Contractors, subcontractors and their employees engaged in the businesses of electrical, mechanical, plumbing, carpentry, sprinkler system work, and other construction related trades shall be licensed to perform such work by the municipal or political subdivision where the project is located, if such licensure is required by local code. Local codes shall dictate the level (master, journeyman, and apprentice) and the number, type and ratio of licensed tradesmen required for this project within the jurisdiction of such municipal or political subdivision.

C. Equipment and controls manufacturers and their authorized service and installation technicians that do not maintain an office within the jurisdiction of the municipal or political subdivision but are a listed or specified contractor or subcontractor on this project are exempt from Paragraph 1.3 B above.

D. The Contractor shall post a copy of the wage determination issued for the project and included as a part of the contract documents, in a prominent and easily accessible location at the site of construction for the duration of the project.

E. Any contractor or subcontractor to such contractor at any tier signing a contract to work on this project shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. The contractor shall forfeit as a penalty to the public body on whose behalf the contract is made or awarded, two thousand five hundred dollars plus one hundred dollars for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

ARTICLE 1.4 - NONDISCRIMINATION IN EMPLOYMENT

A. The Contractor and his subcontractors will not discriminate against individuals based on race, color, religion, national origin, sex, disability, or

age, but may use restrictions which relate to bona fide occupational qualifications. Specifically, the Contractor and his subcontractors shall not discriminate:

1. Against recipients of service on the basis of race, color, religion, national origin, sex, disability or age.
2. Against any employee or applicant, for employment on the basis of race, color, religion, national origin, sex or otherwise qualified disability status.
3. Against any applicant for employment or employee on the basis of age, where such applicant or employee is between ages 40 and 70 and where such Contractor employs at least 20 persons.
4. Against any applicant for employment or employee on the basis of that person's status as a disabled or Vietnam-era veteran.

The Contractor and his Subcontractors will take affirmative action to insure applicants for employment and employees are treated equally without regard to race, color, religion, national origin, sex, disability, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion and transfer; recruitment or recruitment advertising; and selection for training, including apprenticeship. The Contractor and his Subcontractors will give written notice of their commitments under this clause to any labor union with which they have bargaining or other agreements.

B. The Contractor and his Subcontractors shall develop, implement, maintain and submit in writing to the Owner an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed Affidavit for Affirmative Action in the form included in the contract specifications. For the purpose of this section, an "affirmative action program" means positive action to influence all employment practices (including, but not limited to, recruiting, hiring, promoting and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between age 40 and 70), disabled and Vietnam-era veteran status, and disability. Such "affirmative action program" shall include:

1. A written policy statement committing the total organization to affirmative action and assigning management responsibilities and procedures for evaluation and dissemination;
2. The identification of a person designated to handle affirmative action;
3. The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to lay-off, recall, discharge, demotion and discipline;
4. The exclusion of discrimination from all collective bargaining agreements; and
5. Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

In the enforcement of this non-discrimination clause, the Owner may use any reasonable procedures available, including, but not limited to: requests, reports, site visits and inspection of relevant documents of contractors and subcontractors.

C. In the event of the Contractor's or his subcontractor's noncompliance with any provisions of this Article of the Contract, the Owner may cancel this contract in whole or in part or require the Contractor to terminate his contract with the subcontractor.

ARTICLE 1.5 - ANTI-KICKBACK

A. No employee of the division, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract or in any part hereof. No officer, employee, designer, attorney, or administrator of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

ARTICLE 1.6 - PATENTS AND ROYALTIES

A. The Contractor shall hold and save the Owner and its officers, agents, servants and employees harmless from liabilities of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.

B. If the Contractor uses any design, device or materials covered by letters, patent or copyright,

the Contractor shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, without exception, that the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES

A. By virtue of statutory authority a preference will be given to Missouri labor and to products of mines, forests and quarries of the state of Missouri when they are found in marketable quantities in the state, and all such materials shall be of the best quality and suitable character that can be obtained at reasonable market prices, all as provided for in Section 8.280, Missouri Revised Statutes and Cumulative Supplements.

B. Furthermore, pursuant to Section 34.076 Missouri Revised Statutes and Cumulative Supplements, a preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be required for a Missouri bidder to successfully bid in the non-domiciliary state.

C In accordance with the Missouri Domestic Products Procurement Act Section 34.350 RSMo and Cumulative Supplements any manufactured goods or commodities used or supplied in the performance of this contract or any subcontract thereto shall be manufactured, assembled or produced in the United States, unless the specified products are not manufactured, assembled or produced in the United States in sufficient quantities to meet the agency's requirements or cannot be manufactured, assembled or produced in the United States within the necessary time in sufficient quantities to meet the contract requirements, or if obtaining the specified products manufactured, assembled or produced in the United States would increase the cost of this contract for purchase of the product by more than ten percent.

ARTICLE 1.8 - COMMUNICATIONS

A. All notices, requests, instructions, approvals and claims must be in writing and shall be delivered to the Designer and copied to the Construction Representative for the project except as required by Article 1.12 Disputes and Disagreements, or as otherwise specified by the Owner in writing as stated in Section 012600. Any such notice shall be deemed to have been given as of the time of actual receipt.

B. The Contractor shall attend on-site progress and coordination meetings, as scheduled by the Construction Representative, no less than once a month.

C. The Contractor shall ensure that major subcontractors and suppliers shall attend monthly progress meetings as necessary to coordinate the work, and as specifically requested by the Construction Representative.

ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION

A. The Owner reserves the right to let other contracts in connection with this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.

B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner's Representative before the work is performed. If the Contractor fails to do this, and constructs any work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner's Representative at no additional cost to the Owner.

C. Each contractor shall be required to coordinate his work with other contractors so as to afford others reasonable opportunity for execution of their work. No contractor shall delay any other contractor by neglecting to perform contract work at the proper time. If any contractor causes delay to another, they shall be liable directly to that contractor for such delay in addition to any liquidated damages which might be due the Owner.

D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall

coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.

E. Each Contractor shall be responsible for damage done to Owner's or other Contractor's property by him/her or workers in his employ through their fault or negligence.

F. Should a Contractor sustain any damage through any act or omission of any other Contractor having a contract with the Owner, the Contractor so damaged shall have no claim or cause of action against the Owner for such damage, but shall have a claim or cause of action against the other Contractor to recover any and all damages sustained by reason of the acts or omissions of such Contractor. The phrase "acts or omissions" as used in this section shall be defined to include, but not be limited to, any unreasonable delay on the part of any such contractors.

ARTICLE 1.10 - ASSIGNMENT OF CONTRACT

A. No assignment by Contractor of any amount or any part of this contract or of the funds to be received there under will be recognized unless such assignment has had the written approval of the Director and the surety has been given due notice of such assignment and has furnished written consent thereto. In addition to the usual recitals in assignment contracts, the following language must be set forth: "It is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor of this contract and to claims or liens for services rendered or materials supplied for the performance of the work called for in said contract in favor of all persons, firms or corporations rendering such services or supplying such materials."

ARTICLE 1.11 - INDEMNIFICATION

A. Contractor agrees to indemnify and save harmless Owner and its respective commissioners, officers, officials, agents, consultants and employees and Designer, their agents, servants and employees, from and against any and all liability for damage arising from injuries to persons or damage to property occasioned by any acts or omissions of Contractor, any subcontractors, agents, servants or employees, including any and all expense, legal or otherwise, which may be incurred by Owner or Designer, its agents, servants or employees, in defense of any claim, action or suit.

B. The obligations of the Contractor under this paragraph shall not extend to the liability of the Designer, his agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, contract changes, design or specifications, or (2) giving of or the failure to give directions or instructions by the Designer, his agents or employees as required by this contract documents provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 1.12 - DISPUTES AND DISAGREEMENTS

A. It is hereby expressly agreed and understood that in case any controversy or difference of opinion arises during construction, best efforts will be given to resolution at the field level. Should those efforts be unsuccessful, the Contractor has the right to appeal in writing, the decision of the Director's Designee to the Director at Room 730 Truman Building, P.O. Box 809, Jefferson City, Missouri 65102. The decision of the Director shall be final and binding on all parties.

ARTICLE 2 -- OWNER/DESIGNER RESPONSIBILITIES

A. The Owner shall give all orders and directions contemplated under this contract relative to the execution of the work. During progress of work the Owner will be represented at the project site by the Construction Representative and/or Designer, whose responsibilities are to see that this contract is properly fulfilled.

B. The Owner shall at all times have access to the work whenever it is in preparation or progress. The Contractors shall provide proper facilities for such access and for inspection and supervision.

C. All materials and workmanship used in the work shall be subject to the inspection of the Designer and Construction Representative, and any work which is deemed defective shall be removed, rebuilt or made good immediately upon notice. The cost of such correction shall be borne by the Contractor. Contractor shall not be entitled to an extension of the contract completion date in order to remedy defective work. All rejected materials shall be immediately removed from the site of the work.

D. If the Contractor fails to proceed at once with the correction of rejected defective materials or workmanship, the Owner may, by separate contract or otherwise, have the defects remedied or rejected. Materials removed from the site and charge the cost of the same against any monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.

E. Failure or neglect on the part of Owner to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility

for correcting such work without additional compensation.

F. The Owner shall have the right to direct the Contractor to uncover any completed work.

1. If the Contractor fails to adequately notify the Construction Representative and/or Designer of an inspection as required by the Contract Documents, the Contractor shall, upon written request, uncover the work. The Contractor shall bear all costs associated with uncovering and again covering the work exposed.

2. If the Contractor is directed to uncover work, which was not otherwise required by the Contract Documents to be inspected, and the work is found to be defective in any respect, no compensation shall be allowed for this work. If, however, such work is found to meet the requirements of this contract, the actual cost of labor and material necessarily involved in the examination and replacement plus 10% shall be allowed the Contractor.

G. The Designer shall give all orders and directions contemplated under this contract relative to the scope of the work and shall give the initial interpretation of the contract documents.

H. The Owner may file a written notice to the Contractor to dismiss immediately any subcontractors, project managers, superintendents, foremen, workers, watchmen or other employees whom the Owner may deem incompetent, careless or a hindrance to proper or timely execution of the work. The Contractor shall comply with such notice as promptly as practicable without detriment to the work or its progress.

I. If in the Owner's judgment it becomes necessary at any time to accelerate work, when ordered by the Owner in writing, the Contractor shall redirect resources to such work items and execute such portions of the work as may be required to complete the work within the current approved contract schedule.

ARTICLE 3 -- CONTRACTOR RESPONSIBILITIES

ARTICLE 3.1 -- ACCEPTABLE SUBSTITUTIONS

A. The Contractor may request use of any article, device, product, material, fixture, form or type of construction which in the judgment of the Owner and Designer is equal in all respects to that named. Standard products of manufacturers other than those specified will be accepted when, prior to the ordering or use thereof, it is proven to the satisfaction of the Owner and Designer that they are equal in design, strength, durability, usefulness and convenience for the purpose intended.

B. Any changes required in the details and dimensions indicated on the drawings for the substitution of products other than those specified shall be properly made at the expense of the Contractor requesting the substitution or change.

C. The Contractor shall submit a request for such substitutions in writing to the Owner and Designer within twenty (20) working days after the date of the "Notice to Proceed." Thereafter no consideration will be given to alternate forms of accomplishing the work. This Article does not preclude the Owner from exercising the provisions of Article 4 hereof.

D. Any request for substitution by the Contractor shall be submitted in accordance with SECTION 002113 - INSTRUCTIONS TO BIDDERS.

E. When a material has been approved, no change in brand or make will be permitted unless:

1. Written verification is received from the manufacturer stating they cannot make delivery on the date previously agreed, or

2. Material delivered fails to comply with contract requirements.

ARTICLE 3.2 -- SUBMITTALS

A. The Contractor's submittals must be submitted with such promptness as to allow for review and approval so as not to cause delay in the work. The Contractor shall coordinate preparation and processing of submittals with performance of construction activities.

Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

Submit four (4) copies to the Designer and additional copies as required for the subcontractors and material suppliers. Also provide copies to meet the requirements for maintenance manuals.

B. All subcontractors' shop drawings and schedules shall be submitted by the Contractor and shall bear evidence that Contractor has received, reviewed, and approved them. Any shop drawings and schedules submitted without this evidence will be returned to the Contractor for resubmission.

C. The Contractor shall include with the shop drawing, a letter indicating any and all deviations from the drawings and/or specifications. Failure to notify the Designer of such deviations will be grounds for subsequent rejection of the related work or materials. If, in the opinion of the Designer, the deviations are not acceptable, the Contractor will be required to furnish the item as specified and indicated on the drawings.

D. The Designer shall check shop drawings and schedules with reasonable promptness and approve them only if they conform to the design concept of the project and comply with the information given in the contract documents. The approval shall not relieve the Contractor from the responsibility to comply with the drawings and specifications, unless the Contractor has called the Designer's attention to the deviation, in writing, at the time of submission and the Designer has knowingly approved thereof. An approval of any such modification will be given only under the following conditions:

1. It is in the best interest of the Owner
2. It does not increase the contract sum and/or completion time
3. It does not deviate from the design intent
4. It is without prejudice to any and all rights under the surety bond.

E. No extension of time will be granted because of the Contractor's failure to submit shop drawings and schedules in ample time to allow for review, possible resubmission, and approval. Fabrication of work shall not commence until the Contractor has received approval. The Contractor shall furnish prints of approved shop drawings and schedules to all subcontractors whose work is in any way related to the work under this contract. Only prints bearing this approval will be allowed on the site of construction

F. The Contractor shall maintain a complete file on-site of approved shop drawings available for use by the Construction Representative.

ARTICLE 3.3 – AS-BUILT DRAWINGS

A. The Contractor shall update a complete set of the construction drawings, shop drawings and schedules of all work monthly by marking changes, and at the completion of their work (prior to submission of request for final payment) note all changes and turn the set over to the Construction Representative. The updates shall show all addenda, all field changes that were made to adapt to field conditions, changes resulting from contract changes or supplemental instructions, and all locations of structures, buried installations of piping, conduit, and utility services. All buried and concealed items both inside and outside shall be accurately located as to depth and referenced to permanent features such as interior or exterior wall faces and dimensions shall be given in a neat and legible manner in a contrasting colored pencil or ink. If approved by the Designer, an electronic file format may be provided.

ARTICLE 3.4 – GUARANTY AND WARRANTIES

A. General Guaranty

1. Neither the final certificate of payment nor any provision in the contract documents nor partial use or occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with contract requirements.
2. The Contractor or surety shall remedy any defects in the work and pay for any damage to property resulting there from which shall appear within a period of one (1) year from the date of substantial completion unless a longer period is otherwise specified or a differing guaranty period has been established in the substantial completion certificate. The Owner will give notice of observed defects with reasonable promptness.
3. In case of default on the part of the Contractor in fulfilling this part of this contract, the Owner may correct the work or repair the damage and the cost and expense incurred in such event shall be paid by or recoverable from the Contractor or surety.
4. The work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment

B. Extended Warranty

Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year. Where a longer period is offered at no additional cost or called for in the specific equipment specifications, the longer period shall govern.

ARTICLE 3.5 -- OPERATION AND MAINTENANCE MANUALS

A. Immediately after equipment submittals are approved and no later than ten (10) working days prior to the substantial completion inspection, the Contractor shall provide to the Designer three (3)

copies of operating instructions and service manuals, containing the following:

1. Start-up and Shut-down Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available; they may be incorporated into the operating manual for reference.
2. Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
3. Equipment List: List of all major equipment as installed shall be prepared to include model number, capacities, flow rate, name place data, shop drawings and air and water balance reports.
4. Service Instructions: Provide the following information for all pieces of equipment.
   a. Recommended spare parts including catalog number and name of local supplier or factory representative.
   b. Belt sizes, types, and lengths.
   c. Wiring diagrams.
5. Manufacturer's Certificate of Warranty as described in Article 3.4.
6. Prior to the final payment, furnish to the Designer three (4) copies of parts catalogs for each piece of equipment furnished by him/her on the project with the components identified by number for replacement ordering.

B. Submission of operating instructions shall be done in the following manner.

1. Manuals shall be in quadruplicate, and all materials shall be bound into volumes of standard 8½" x 11" hard binders. Large drawings too bulky to be folded into 8½" x 11" shall be separately bound or folded and in envelopes, cross referenced and indexed with the manuals.
2. The manuals shall identify project name, project number, and include the name and address of the Contractor, subcontractors and manufacturers who were involved with the activity described in that particular manual.
3. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titles clearly printed under reinforced laminated plastic tabs.
4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.

ARTICLE 3.6 – OTHER CONTRACTOR RESPONSIBILITIES

A. The Contractor shall keep on site, during progress of the work, a competent superintendent satisfactory to the Construction Representative. The superintendent shall represent the Contractor and all agreements made by the superintendent shall be binding. The superintendent shall carefully study and compare all drawings, specifications and other instructions and shall promptly notify the Construction Representative and Designer, in writing, any error, inconsistency or omission which may be discovered. The superintendent shall coordinate all work on the project. Any change of the superintendent shall be approved by the Construction Representative.

B. Contractor shall, at all times, enforce strict discipline and good order among his employees, and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him/her.

C. The Contractor shall supply sufficient labor, material, plant and equipment and pay when due any laborer, subcontractor or supplier for supplies furnished and otherwise prosecute the work with diligence to prevent work stoppage and insure completion thereof within the time specified.

D. The Contractor and each of his subcontractors shall submit to the Construction Representative, through the Designer such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.

E. The Contractor, subcontractors, and material suppliers shall upon written request, give the Owner access to all time cards, material invoices, payrolls, estimates, profit and loss statements, and all other direct or indirect costs related to this work.

F. The Contractor shall be responsible for laying out all contract work such as layout of architectural, structural, mechanical and electrical work, which shall be coordinated with layouts of subcontractors for general construction work. The Contractor is also responsible for unloading, uncrating and handling of all materials and equipment to be erected or placed by him/her, whether furnished by Contractor or others. No extra charges or compensation will be allowed as a result of failure to verify dimensions before ordering materials or fabricating items.

G. The Contractor must notify the Construction Representative at least one working day before

placing concrete or burying underground utilities, pipelines, etc.

H. Contractors shall prearrange time with the Construction Representative for the interruption of any facility operation. Unless otherwise specified in these documents, all connections, alterations or relocations as well as all other portions of the work will be performed during normal working hours.

I. The Contractor shall coordinate all work so there will not be prolonged interruptions of existing equipment operation. Any existing plumbing, heating, ventilating, air conditioning or electrical disconnections necessary for the project, which affect portions of this construction or building or any other building must be scheduled with the Construction Representative to minimize or avoid any disruption of facility operations. In no case, unless previously approved in writing by the Construction Representative, shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities either intentionally or accidentally shall not relieve the Contractor responsible for the interruption from the responsibility to repair and restore the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

J. Contractors shall limit operations and storage of materials to the area within the project, except as necessary to connect to existing utilities, and shall not encroach on neighboring property. The Contractor shall be responsible for repair of their damage to property on or off the project site occurring during construction of project. All such repairs shall be made to the satisfaction of the property owner.

K. Unless otherwise permitted, all materials shall be new and both workmanship and materials shall be of the best quality.

L. Unless otherwise provided and stipulated within these specifications, the Contractor shall furnish, construct, and/or install and pay for materials, devices, mechanisms, equipment, all necessary personnel, utilities including, but not limited to water, heat, light and electric power, transportation services, applicable taxes of every nature, and all other facilities necessary for the proper execution and completion of the work.

M. Contractor shall carefully examine the plans and drawings and shall be responsible for the proper fitting of his material, equipment and apparatus into the building.

N. The Contractor or subcontractors shall not overload, or permit others to overload, any part of any structure during the performance of this contract.

O. All temporary shoring, bracing, etc., required for the removal of existing work and/or for the installation of new work shall be included in this contract. The Contractor shall make good, at no cost to the Owner, any damage caused by improper support or failure of shoring in any respect. Each Contractor shall be responsible for shoring required to protect his work or adjacent property and improvements of Owner and shall be responsible for shoring or for giving written notice to adjacent property owners. Shoring shall be removed only after completion of permanent supports.

P. The Contractor shall provide at the proper time such material as is required for support of the work. If openings are required, whether shown on drawings or not, the Contractor shall see that they are properly constructed.

Q. During the performance of work the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other devices appropriately located on site which will give proper and understandable warning to all persons of danger of entry onto land, structure or equipment.

R. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials.

S. The Contractor shall be responsible for care of the finished work and shall protect same from damage or defacement until substantial completion by the Owner. If the work is damaged by any cause, the Contractor shall immediately begin to make repairs in accordance with the drawings and specifications. Contractor shall be liable for all damage or loss unless attributable to the acts or omissions of the Owner or Designer. Any claim for reimbursement shall be submitted in accordance with Article 4. After substantial completion the Contractor will only be responsible for damage resulting from acts or omissions of the Contractor or subcontractors through final warranty.

T. In the event the Contractor encounters an unforeseen hazardous material, the Contractor shall immediately stop work in the area affected and report the condition to the Owner and Designer in writing. The Contractor shall not be required, pursuant to Article 4, to perform, any work relating to hazardous materials.

U. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation

or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 4.

V. Before commencing work, Contractors shall confer with the Construction Representative and facility representative and review any facility rules and regulations which may affect the conduct of the work.

W. Project signs will only be erected on major projects and only as described in the specifications. If no sign is specified, none shall be erected.

ARTICLE 3.7 -- SUBCONTRACTS

A. Subcontractor assignments as identified in the bid form shall not be changed without written approval of the Owner. The Owner will not approve changes of a listed subcontractor unless the Contractor documents, to the satisfaction of the Owner that the subcontractor cannot or will not perform the work as specified.

B. The Contractor is fully responsible to the Owner for the acts and omissions of all subcontractors and of persons either directly or indirectly employed by them.

C. Every subcontractor shall be bound by the applicable terms and provisions of these contract documents, but no contractual relationship shall exist between any subcontractor and the Owner unless the right of the Contractor to proceed with the work is suspended or this contract is terminated as herein provided, and the Owner in writing elects to assume the subcontract.

D. The Contractor shall upon receipt of "Notice to Proceed" and prior to submission of the first payment request, notify the Designer and Construction Representative in writing of the names of any subcontractors to be used in addition to those identified in the bid form and all major material suppliers proposed for all parts of the work.

ARTICLE 4 -- CHANGES IN THE WORK

4.1 CHANGES IN THE WORK

A. The Construction Representative, without giving notice to the surety and without invalidating this contract, may order extra work or make changes by altering, adding to or deducting from the work, this contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract. A claim for extension of time caused by any change must be adjusted at the time of ordering such change. No future request for time will be considered.

B. Each Contract Change shall include all costs required to perform the work including all labor, material, equipment, overheads and profit, delay, disruptions, or other miscellaneous expenses. No subsequent requests for additional compensation including claims for delay, disruption, or reduced efficiency as a result of each change will be considered. Values from the Schedule of Values will not be binding as a basis for additions to or deductions from the contract price.

C. The amount of any adjustment in this contract price for authorized changes shall be agreed upon before such changes become effective and shall be determined, through submission of a request for proposal, as follows:

1. By an acceptable fixed price proposal from the Contractor. Breakdowns shall include all takeoff sheets of each Contractor and subcontractor. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.

2. By a cost-plus-fixed-fee (time and material) basis with maximum price, total cost not to exceed said maximum. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.

3. By unit prices contained in Contractor's original bid form and incorporated in the construction contract.

D. Overhead and Profit on Contract Changes shall be applied as follows:

1. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: incidental job burdens, small truck (under 1 ton) expense, mileage, small hand tools, warranty costs, company benefits and general office overhead. Project supervision including field supervision and job site office expense shall be considered a part of overhead and profit unless a compensable time extension is granted.

2. The percentages for overhead and profit charged on Contract Changes shall be negotiated, and may vary according to the nature, extent, and complexity of the work

involved. However, the overhead and profit for the Contractor or subcontractor actually performing the work shall not exceed 14%. When one or more tiers of subcontractors are used, in no event shall any Contractor or subcontractor receive as overhead and profit more than 3% of the cost of the work performed by any of his subcontractors. In no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty percent (20%) of the cost of materials, labor and equipment (exclusive of Contractor or any Subcontractor overhead and profit) necessary to put the contract change work in place.

3. The Contractor will be allowed to add the cost of bonding and insurance to their cost of work. This bonding and insurance cost shall not exceed 2% and shall be allowed on the total cost of the added work, including overhead and profit.

4. 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.

5. The percentage for overhead and profit to be credited to the Owner on Contract Changes that are solely decreases in the quantity of work or materials shall 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%). If the percentage for overhead and profit charged for work added by Contract Changes for this contract has been negotiated to less than 10%, the negotiated rate shall then apply to credits as well.

E. No claim for an addition to this contract sum shall be valid unless authorized as aforesaid in writing by the Owner. In the event that none of the foregoing methods are agreed upon, the Owner may order the Contractor to perform work on a time and material basis. The cost of such work shall be determined by the Contractor's actual labor and material cost to perform the work plus overhead and profit as outlined herein. The Designer and Construction Representative shall approve the Contractor's daily time and material invoices for the work involved.

F. If the Contractor claims that any instructions involve extra cost under this contract, the Contractor shall give the Owner's Representative written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute the work. No such claim shall be valid unless so made and authorized by the Owner, in writing.

G. In an emergency affecting the safety of life or of the structure or of adjoining property, the Contractor, without special instruction or authorization from the Construction Representative, is hereby permitted to act at their discretion to prevent such threatened loss or injury. The Contractor shall submit a claim for compensation for such emergency work in writing to the Owner's Representative.

ARTICLE 4.2 – CHANGES IN COMPLETION TIME

A. Extension of the number of work days stipulated in the Contract for completion of the work with compensation may be made when:

1. The contractor documents that proposed Changes in the work, as provided in Article 4.1, extends construction activities critical to contract completion date, OR

2. The Owner suspends all work for convenience of the Owner as provided in Article 7.3, OR

3. An Owner caused delay extends construction activities critical to contract completion (except as provided elsewhere in these General Conditions). The Contractor is to review the work activities yet to begin and evaluate the possibility of rescheduling the work to minimize the overall project delay.

B. Extension of the number of work days stipulated in the Contract for completion of the work <u>without</u> compensation may be made when:

1. Weather-related delays occur, subject to provisions for the inclusion of a specified number of "bad weather" days when provided for in Section 012100-Allowances, OR

2. Labor strikes or acts of God occur, OR

3. The work of the Contractor is delayed on account of conditions which were beyond the control of the Contractor, subcontractors or suppliers, and were not the result of their fault or negligence.

C. No time extension or compensation will be provided for delays caused by or within the control of the Contractor, subcontractors or suppliers and for concurrent delays caused by the Owner.

D. The Contractor shall notify the Owner promptly of any occurrence or conditions which in the Contractor's opinion results in a need for an extension of time. The notice shall be in writing and shall include all necessary supporting materials with details of any resultant costs and be submitted in time to permit full investigation and

evaluation of the Contractor's claim. The Owner shall promptly acknowledge the Contractor's notice and, after recommendation from the Owner's Representative and/or Designer, shall provide a decision to the Contractor. Failure on the part of the Contractor to provide such notice and to detail the costs shall constitute a waiver by the Contractor of any claim. Requests for extensions of time shall be for working days only.

ARTICLE 5 - CONSTRUCTION AND COMPLETION

ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT

A. Upon receipt of the "Intent to Award" letter, the Contractor must submit the following properly executed instruments to the Owner:

1. Contract;
2. Performance/payment bond as described in Article 6.1;
3. Certificates of Insurance, or the actual policies themselves, showing that the Contractor has obtained the insurance coverage required by Article 6.2.
4. Written Affirmative Action Plans as required in Article 1.4.

Above referenced items must be received by the Owner within ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.

B. Within the time frame noted in Section 013200 - Schedules, following receipt of the "Notice to Proceed", the Contractor shall submit to the Owner a progress schedule and schedule of values, showing activities through the end of the contract period. Should the Contractor not receive written notification from the Owner of the disapproval of the schedule of values within fifteen (15) working days, the Contractor may consider it approved for purpose of determining when the first monthly Application and Certification for Payment may be submitted.

C. The Contractor may commence work upon receipt of the Division of Facilities Management, Design and Construction's "Notice to Proceed" letter. Contractor shall prosecute the work with faithfulness and energy, and shall complete the entire work on or before the completion time stated in the contract documents or pay to the Owner the damages resulting from the failure to timely complete the work as set out within Article 5.4.

ARTICLE 5.2 -- PROJECT CONSTRUCTION

A. Each Contractor shall submit for the Owner's approval, in reproducible form, a progress schedule showing the rate of progress and the order of the work proposed to carry on various phases of the project. The schedule shall be in conformance with the requirements outlined in Section 013200 – Schedules.

B. Contractor shall employ and supply a sufficient force of workers, material, and equipment and shall pay when due, any worker, subcontractor or supplier and otherwise prosecute the work with such diligence so as to maintain the rate of progress indicated on the progress schedule, prevent work stoppage, and insure completion of the project within the time specified.

ARTICLE 5.3 -- PROJECT COMPLETION

A. Substantial Completion. A Project is substantially complete when construction is essentially complete and work items remaining to be completed can be done without interfering with the Owner's ability to use the Project for its intended purpose.

1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
   a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
   b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
   c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working days notice before the inspection shall be performed.
2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be

performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.

3. If the work is not acceptable, and the Owner does not issue a Certificate of Substantial Completion, the Owner shall be entitled to charge the Contractor with the Designer's and Owner's costs of re-inspection, including time and travel.

B. Partial Occupancy. Contractor agrees that the Owner shall be permitted to occupy and use any completed or partially completed portions of the Project, when such occupancy and use is in the Owner's best interest. Owner shall notify Contractor of its desire and intention to take Partial Occupancy as soon as possible but at least ten (10) working days before the Owner intends to occupy. If the Contractor believes that the portion of the work the Owner intends to occupy is not ready for occupancy, the Contractor shall notify the Owner immediately. The Designer shall inspect the work in accordance with the procedures above. If the Contractor claims increased cost of the project or delay in completion as a result of the occupancy, he shall notify the Owner immediately but in all cases before occupancy occurs.

C. Final Completion. The Project is finally complete when the Certificate of Substantial Completion has been issued and all work items identified therein as incomplete have been completed, and when all administrative items required by the contract have been completed. Final Completion entitles the Contractor to payment of the outstanding balance of the contract amount including all change orders and retainage. Within five (5) working days of the date of the Certificate of Substantial Completion, the Contractor shall identify the cost to complete any outstanding items of work. The Designer shall review the Contractor's estimate and either approve it or provide an independent estimate for all such items. If the Contractor fails to complete the remaining items within the time specified in the Certificate, the Owner may terminate the contract and go to the surety for project completion in accordance with Article 7.2 or release the contract balance to the Contractor less 150% of the approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

D. Liquidated Damages. Contractor agrees that the Owner may deduct from the contract price and retain as liquidated damages, and not as penalty or forfeiture, the sum stipulated in this contract for each work day after the Contract Completion Day on which work is not Substantially Complete. Assessment of Liquidated Damages shall not relieve the Contractor or the surety of any responsibility or obligation under the Contract. In addition, the Owner may, without prejudice to any other rights, claims, or remedies the Owner may have including the right to Liquidated Damages, charge the Contractor for all additional expenses incurred by the Owner and/or Designer as the result of the extended contract period through Final Completion. Additional Expenses shall include but not be limited to the costs of additional inspections.

E. Early Completion. The Contractor has the right to finish the work before the contract completion date; however, the Owner assumes no liability for any hindrances to the Contractor unless Owner caused delays result in a time extension to the contract completion date. The Contractor shall not be entitled to any claims for lost efficiencies or for delay if a Certificate of Substantial Completion is given on or before the Contract Completion Date.

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make

payment within 30 calendar days after the "Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:

1. Updated construction schedule
2. Certified payrolls consisting of name, occupation and craft, number of hours worked and actual wages paid for each individual employee, of the Contractor and all subcontractors working on the project

B. The Owner shall retain 5 percent of the amount of each such payment application, except as allowed by Article 5.4, until final completion and acceptance of all work covered by this contract.

C. Each payment made to Contractor shall be on account of the total amount payable to Contractor and all material and work covered by paid partial payment shall thereupon become the sole property of Owner. This provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work or as a waiver of the right of Owner to require fulfillment of all terms of this contract.

D. Materials delivered to the work site and not incorporated in the work will be allowed in the Application and Certification for Payment on the basis of one hundred (100%) percent of value, subject to the 5% retainage providing that they are suitably stored on the site or in an approved warehouse in accordance with the following requirements:

1. Material has previously been approved through submittal and acceptance of shop drawings conforming to requirements of Article 3.2 of General Conditions.
2. Delivery is made in accordance with the time frame on the approved schedule.
3. Materials, equipment, etc., are properly stored and protected from damage and deterioration and remain so - if not, previously approved amounts will be deleted from subsequent pay applications.
4. The payment request is accompanied by a breakdown identifying the material equipment, etc. in sufficient detail to establish quantity and value.

E. The Contractor shall be allowed to include in the Application and Certification for Payment, one hundred (100%) of the value, subject to retainage, of major equipment and material stored off the site if all of the following conditions are met:

1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.
2. Materials stored in one location off site are valued in excess of $25,000.
3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.
4. The materials are stored in a facility approved and inspected, by the Construction Representative.
5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.

F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.

G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:

1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or items. The cost of corrective action(s) shall be borne by the Contractor.
2. A reasonable doubt that this contract can be completed for the unpaid balance.
3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.
4. Failure of the Contractor to update the construction schedule.

When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.

H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.

1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.

2. The final payment shall not become due until the Contractor delivers to the Construction Representative:
   a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from the Surety to final payment accepting liability for any unpaid amounts.
   b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor
   c) Certified copies of all payrolls
   d) As-built drawings

3. If any claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a claim including all costs and a reasonable attorney's fee.

4. Missouri statute requires prompt payment from the Owner to the Contractor within thirty calendar days and from the Contractor to his subcontractors within fifteen calendar days. Failure to make payments within the required time frame entitles the receiving party to charge interest at the rate of one and one half percent per month calculated from the expiration of the statutory time period until paid.

5. The value of all unused unit price allowances and/or 150% of the value of the outstanding work items, and/or liquidated damages may be deducted from the final pay request without executing a Contract Change. Any unit price items which exceed the number of units in the contract may be added by Contract Change.

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

A. Contractor shall furnish a performance/payment bond in an amount equal to 100% of the contract price to guarantee faithful performance of the contract and 100% of the contract price to guarantee the payment of all persons performing labor on the project and furnishing materials in connection therewith under this contract as set forth in the standard form of performance and payment bond included in the contract documents. The surety on such bond shall be issued by a surety company authorized by the Missouri Department of Insurance to do business in the state of Missouri.

B. All Performance/Payment Bonds furnished in response to this provision shall be provided by a bonding company with a rating of B+ or higher as established by A.M. Best Company, Inc. in their most recent publication.

ARTICLE 6.2 – INSURANCE

A. The successful Contractor shall procure and maintain for the duration of the contract issued a policy or policies of insurance for the protection of both the Contractor and the Owner and their respective officers, officials, agents, consultants and employees. The Owner requires certification of insurance coverage from the Contractor prior to commencing work.

B. Minimum Scope and Extent of Coverage

1. General Liability

   Commercial General Liability, ISO coverage form number or equivalent CG 00 01 ("occurrence" basis), or I-SO coverage form number CG 00 02, or ISO equivalent.

   If ISO equivalent or manuscript general liability coverage forms are used, minimum coverage will be as follows: Premises/Operations;Independent Contractors; Products/Completed Operations; personal Injury; Broad Form Property Damage including Completed Operations; Broad Form Contractual Liability Coverage to include Contractor's obligations under Article 1.11 Indemnification and any other Special Hazards required by the work of the contract.

2. Automobile Liability

   Business Automobile Liability Insurance, ISO Coverage form number or equivalent CA 00 01 covering automobile liability, code 1 "ANY AUTO".

3. Workers' Compensation and Employer's Liability

   Statutory Workers' Compensation Insurance for Missouri and standard Employer's Liability Insurance, or the authorization to self-insure for such liability from the Missouri Division of Workers' Compensation.

4. Builder's Risk or Installation Floater Insurance

   Insurance upon the work and all materials, equipment, supplies, temporary structures and similar items which may be incident to the performance of the work and located at or adjacent to the site, against loss or damage from fire and such other casualties as are included in extended coverage in broad "All Risk" form, including coverage for Flood and Earthquake, in an amount not less than the replacement cost of the work or this contact price, whichever is greater, with loss payable to Contractor and Owner as their respective interests may appear.

   Contractor shall maintain sufficient insurance to cover the full value of the work and materials as the work progresses, and shall furnish Owner copies of all endorsements. If Builder's Risk Reporting- Form of Endorsement is used, Contractor shall make all reports as required therein so as to keep in force an amount of insurance which will equal the replacement cost of the work, materials, equipment, supplies, temporary structures, and other property covered thereby; and if, as a result of Contractor's failure to make any such report, the amount of insurance so recoverable shall be less than such replacement cost, Contractor's interest in the proceeds of such insurance, if any, shall be subordinated to Owner's interest to the end that Owner may receive full reimbursement for its loss.

C. Minimum Limits of Insurance

   1. General Liability

      Contractor

      $2,000,000 combined single limit per occurrence for bodily injury, personal injury, and property damage

      $2,000,000 annual aggregate

   2. Automobile Liability

      $2,000,000 combined single limit per occurrence for bodily injury and property damage

   3. Workers'Compensation and Employers Liability

      Workers' Compensation limits as required by applicable State Statutes (generally unlimited) and minimum of $1,000,000 limit per accident for Employer's Liability.

      General Liability and Automobile Liability insurance may be arranged under individual policies for the full limits required or by a combination of underlying policies with the balance provided by a form-following Excess or Umbrella Liability policy.

D. Deductibles and Self-Insured Retentions

   All deductibles, co-payment clauses, and self-insured retentions must be declared to and approved by the Owner. The Owner reserves the right to request the reduction or elimination of unacceptable deductibles or self-insured retentions, as they would apply to the Owner, and their respective officers, officials, agents, consultants and employees. Alternatively, the Owner may request Contractor to procure a bond guaranteeing payment of losses and related investigations, claims administration, and defense expenses.

E. Other Insurance Provisions and Requirements

   The respective insurance policies and coverage, as specified below, must contain, or be endorsed to contain the following conditions or provisions:

   1. General Liability

      The Owner, and its respective commissioners, officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 Additional

Insured - Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance of self-insurance programs maintained by the designated additional -insured's shall be excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's general liability insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner, or for any of their officers, officials, agents, consultants or employees.

2. Automobile Insurance

The Owner, and their respective officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 - Additional Insured Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance or self-insurance programs maintained by the designated additional insured's shall be in excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's automobile insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner or for any of its officers, officials, agents, consultants or employees.

3. Workers' Compensation/Employer's Liability

Contractor's workers' compensation insurance shall be endorsed with NCCI form WC 00 03 01 A - Alternative Employer Endorsement. The Alternative Employer Endorsement shall designate the Owner as "alternate employers."

4. All Coverages

Each insurance policy required by this section of the Contract shall contain a stipulation, endorsed if necessary, that the Owner will receive a minimum of a thirty (30) calendar day advance notice of any policy cancellation. Ten (10) calendar days advance notice is required for policy cancellation due to non-payment of premium.

F. Insurer Qualifications and Acceptability

Insurance required hereunder shall be issued by an A.M. Best, "B+" rated, Class IX insurance company approved to conduct insurance business in the state of Missouri.

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor-shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor's applicable insurance coverage expires prior to completion of the work or services required under this contract - the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

A. When conditions at the site of the proposed work are considered by the Owner to be unsatisfactory for prosecution of the work, the Contractor may be ordered in writing to suspend the work or any part thereof until reasonable conditions exist. When such suspension is not due to fault or negligence of the Contractor, time allowed for completion of such suspended work will be extended by a period of time equal to that lost due to delay occasioned by ordered suspension. This will be a no cost time extension.

ARTICLE 7.2 - FOR CAUSE

A. Termination or Suspension for Cause:

1. If the Contractor shall file for bankruptcy, or should make a general assignment for the benefit of the creditors, or if a receiver should be appointed on account of insolvency, or if the contractor should persistently or repeatedly refuse or fail to supply enough properly skilled workers or proper materials, or if the contractor should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Owner, or otherwise be guilty of a substantial violation of any provision of this contract, then the Owner may serve notice on the Contractor and the surety setting forth the violations and demanding compliance with this contract. Unless within ten (10) consecutive calendar days after serving such notice, such violations shall cease and satisfactory arrangements for correction be made, the Owner may suspend the Contractor's right to proceed with the work or terminate this contract.

2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.

B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.

C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.

D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.

E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.

F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

ARTICLE 7.3 -- FOR CONVENIENCE

A. The Owner may terminate or suspend the Contract or any portion of the Work without cause at any time, and at the Owner's convenience. Notification of a termination or suspension shall be in writing and shall be given to the Contractor and their surety. If the Contract is suspended, the notice will contain the anticipated duration of the suspension or the conditions under which work will be permitted to resume. If appropriate, the Contractor will be requested to demobilize and re-mobilize and will be reimbursed time and costs associated with the suspension.

B. Upon receipt of notification, the Contractor shall:

1. Cease operations when directed.
2. Take actions to protect the work and any stored materials.
3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.
4. Terminate all existing subcontracts, rentals, material, and equipment orders.
5. Settle all outstanding liabilities arising from termination with subcontractors and suppliers.
6. Transfer title and deliver to the Owner, work in progress, completed work, supplies and other material produced or acquire for the work terminated, and completed or partially completed plans, drawings information and other property that, if the Contract had been completed, would be required to be furnished to the Owner.

C. For termination without cause and at the Owner's convenience, in addition to payment for work completed prior to date of termination, the Contractor may be entitled to payment of other documented costs directly associated with the early termination of the contract. Payment for anticipated profit and unapplied overhead will not be allowed.

SECTION 007300 - SUPPLEMENTARY CONDITIONS

1.0 GENERAL:

A. These Supplementary General Conditions clarify, add, delete, or otherwise modify standard terms and conditions of DIVISION 0, BIDDING AND CONTRACTING REQUIREMENTS.

2.0 CONTACTS:

Designer:	John Potter GLMV Architecture, Inc. 9229 Ward Parkway, Ste 210 Kansas City, MO 64114 Telephone: 816-444-4200 Email: john.potter@glmv.com
Project Manager & Construction Representative:	Jeremy Newton, MONG 6819a North Boundary Road Jefferson City, MO 65101 Telephone: 573-308-6894 Email: jeremy.l.newton.nfg@mail.mil
Contract Specialist:	Kelly Copeland Division of Facilities Management, Design and Construction 301 West High Street, Room 730 Jefferson City, Missouri 65102 Telephone: 573-522-2283 Email: kelly.copeland@oa.mo.gov

3.0 NOTICE: ALL BID MATERIALS ARE DUE AT THE TIME OF BID SUBMITTAL. THERE IS NO SECOND SUBMITTAL FOR THIS PROJECT.

4.0 FURNISHING CONSTRUCTION DOCUMENTS:

A. The Owner will furnish the Contractor with approximately 6 complete sets of drawings and specifications at no charge.
B. The Owner will furnish the Contractor with approximately 6 sets of explanatory or change drawings at no charge.
C. The Contractor may make copies of the documents as needed with no additional cost to the Owner.

5.0 ILLEGAL IMMIGRATION REFORM AND IMMIGRANT RESPONSIBILITY ACT

The Contractor understands and agrees that by signing a contract for this project, they certify the following:

A. The Contractor shall only utilize personnel authorized to work in the United States in accordance with applicable federal and state laws. This includes but is not limited to the Illegal Immigration Reform and Immigrant Responsibility Act (IIRIRA) and INA Section 274A.
B. If the Contractor is found to be in violation of this requirement or the applicable laws of the state, federal and local laws and regulations, and if the State of Missouri has reasonable cause to believe that the Contractor has knowingly employed individuals who are not eligible to work in the United States, the state shall have the right to cancel the contract immediately without penalty or recourse and suspend or debar the contractor from doing business with the state.
C. The Contractor agrees to fully cooperate with any audit or investigation from federal, state or local law enforcement agencies.

6.0 SAFETY REQUIREMENTS

Contractor and subcontractors at any tier shall comply with RSMo 292.675 and Article 1.3, E, of Section 007213, General Conditions.

7.0 ENVIRONMENTAL MANAGEMENT SYSTEM (eMS):

The Missouri Army National Guard (MOARNG) has implemented an Environmental Management System (eMS). One of the key components of the eMS is the establishment of an Environmental Policy that must be communicated to all persons working for or on behalf of the organization including all suppliers and contractors. This policy stresses commitment to compliance with accepted environmental practices, and meeting or exceeding applicable environmental requirements, legal and otherwise.

This policy also stresses commitment to waste minimization, pollution prevention, and management of personnel, processes, real property, and materials in a manner to reduce environmental impacts. The policy is available upon request to all parties by contacting the Environmental Management Office at (573) 638-9514.

8.0 OFF-SITE BORROW & SPOIL DEPOSIT SITES FOR FEDERALLY FUNDED PROJECTS:

A. All Federally funded projects which involve off-site borrow and/or off-site spoil deposit sites will require written certification that the site(s) are in compliance with the National Environmental Protection Act and all related applicable Federal and State laws and regulations. If the need for off-site borrow and/or spoil sites is stipulated in the Contract Documents, the following applies:

B. The Contractor is required to use only the designated site described in the Contract Documents. If another off-site area is proposed by the Contractor, the Contractor must provide written certification to the Division of Facilities Management, Design and Construction Project Representative that the proposed borrow or spoil site has been cleared of environmental concerns in accordance with all applicable Federal and State laws and regulations. These include but are not limited to the following: Clean Water Act; the Endangered Species Act; the National Historic Preservation Act (NHPA) (The site must have Section 106 Clearance); the Farmland Protection Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response; Compensation and Liability Act; and RSMo Chapter 194, Section 194.400, Unmarked Human Burial Sites. Certifications shall include clearance letters and other evidence of coordination with the appropriate regulatory agencies. The Missouri Historic Preservation Office, PO Box 176 Jefferson City, MO 65102, may be contacted to provide assistance with the NHPA and cultural resource issues pertaining to the borrow and spoil site regulations. The Missouri State Historic Preservation Office can provide a list of qualified and certified archaeologists to assist in borrow and spoil site investigations.

C. If project conditions require off-site borrow or off-site deposit of spoils, the Contractor will be required to provide written certification to the Division of Facilities Management, Design and Construction Project Representative that the proposed borrow or spoil site has been cleared of environmental concerns in accordance with all applicable Federal and State laws and regulations. These include but are not limited to the following: Clean Water Act; the Endangered Species Act; the National Historic Preservation Act (NHPA) (The site must have Section 106 Clearance); the Farmland Protection Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response; Compensation and Liability Act; and RSMo Chapter 194, Section 194.400, Unmarked Human Burial Sites. Certifications shall include clearance letters and other evidence of coordination with the appropriate regulatory agencies. The Missouri Historic Preservation Office, PO Box 176 Jefferson City, MO 65102, may be contacted to provide assistance with the NHPA and cultural resource issues pertaining to the borrow and spoil site regulations. The Missouri State Historic Preservation Office can provide a list of qualified and certified archaeologists to assist in borrow and spoil site investigations.

D. The Owner recognizes that additional time (beyond what is allowed in the Construction Contract) may be required in order to secure the aforementioned certifications and approvals. Should more time be required, the Owner will consider approval of a no-cost time extension contract change. The Contractor will be required to provide documentation that substantiates the need for the time extension.

Missouri
Division of Labor Standards
WAGE AND HOUR SECTION

MICHAEL L. PARSON, Governor

Annual Wage Order No. 27

Section 073
NEWTON 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
Taylor Burks, Director
Division of Labor Standards

Filed With Secretary of State: **March 10, 2020**

Last Date Objections May Be Filed: **April 9, 2020**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	*$23.92
Boilermaker	*$23.92
Bricklayer	*$23.92
Carpenter	**$30.15**
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	*$23.92
Plasterer	
Communications Technician	*$23.92
Electrician (Inside Wireman)	**$43.70**
Electrician Outside Lineman	*$23.92
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	*$23.92
Glazier	*$23.92
Ironworker	*$23.92
Laborer	$34.06
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	*$23.92
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	$29.62
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	*$23.92
Plumber	*$23.92
Pipe Fitter	
Roofer	**$37.46**
Sheet Metal Worker	$49.09
Sprinkler Fitter	*$23.92
Truck Driver	*$23.92
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received less than 1,000 reportable hours for this occupational title.
Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.
**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	$45.95
Millwright	
Pile Driver	
Electrician (Outside Lineman)	*$23.92
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	**$40.10**
General Laborer	
Skilled Laborer	
Operating Engineer	**$47.09**
Group I	
Group II	
Group III	
Group IV	
Truck Driver	*$23.92
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

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.

*The Division of Labor Standards received less than 1,000 reportable hours for this occupational title.
Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME
and
HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, **"overtime work"** shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January First;
The last Monday in May;
July Fourth;
The first Monday in September;
November Eleventh;
The fourth Thursday in November; and
December Twenty-Fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

SECTION 011000 – SUMMARY OF WORK

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 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of a new 30-Man Barracks.

1. Project Location: Camp Crowder Training Site, Neosho, Missouri.
2. Owner:
   a. State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S. Truman State Office Building, Post Office Box 809, 301 W. High Street, Jefferson City, Missouri 65102.
   b. Missouri National Guard (MONG), 6819A North Boundary Road, Jefferson City, Missouri 65101.

B. Contract Documents, dated May 28, 2020, were prepared for the Project by GLMV Architecture, Inc., Kansas City, Missouri.

C. The Work consists of the construction of a 30-Man Barracks and all associated site work including (but not limited to) erosion control measures, sidewalks, building pad preparation, utility connections, rough and final grading and establishment of landscape materials.

1. The Work includes an exterior envelope consisting of pre-finished metal wall panels, pre-finished metal roof panels, associated trim and flashing components, insulation values as dictated by the applicable energy code(s), laminated glazing set inside aluminum frames, a combination of aluminum storefront entries and hollow metal insulated doors.
2. The Work includes an internal structural frame based upon a pre-engineered design consisting of primary clear-span structural beams, wall girts, roof purlins and end-wall steel columns.
3. The Work includes typical interior partitions such as fire-rated and non-fire-rated gypsum board walls and concrete masonry units (CMU). Fire-rated walls extend to building roof deck.
4. The Work includes additional structural reinforcement (apart from the pre-engineered design) to resist tornado-force winds for an internal storm shelter.
5. The Work includes split-system furnace/air-conditioning systems with distribution ductwork, vents, exhausts, supply and return terminals and control system; domestic water connection, backflow preventer, distribution piping, hot water equipment and fixtures; fire-sprinkler system with distribution piping, head terminations and drain components; waste line connection with distribution piping, cleanouts, vents and floor drains; fire alarm with all necessary components for a fully completed system.

D. The Work will be constructed under a single prime contract.

1.3 DESIGNER'S ESTIMATE OF CONSTRUCTION COSTS

A. The Project Designer has estimated the Project cost range from $729,000 to $1,000,000.

1.4 WORK SEQUENCE

A. The Work will be conducted in 1 phase.

1. All Work shall be Substantially Complete, ready for occupancy within 160 working days of issuance of Notice of Intent to Award.

1.5 CONTRACTOR USE OF PREMISES

A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.

B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within Contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.6 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: The Owner will occupy the site and existing buildings during the entire construction period at the site. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 011000

SECTION 012100 – ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Certain items and associated installation costs are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Contract Change.

B. Types of Allowances Include the Following: Weather allowances.

C. Related Sections include Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Contract Changes for allowances.

1.3 WEATHER ALLOWANCE

A. Included within the completion period for this Project are a specified number of “bad weather” days (see Schedule of Allowances).

B. The Contractor’s progress schedule shall clearly indicate the bad weather day allowance as an “activity” or “activities.” In the event weather conditions preclude performance of critical work activities for 50 percent or more of the Contractor’s scheduled workday, that day shall be declared unavailable for work due to weather (a “bad weather” day) and charged against the above allowance. Critical work activities will be determined by review of the Contractor’s current progress schedule.

C. The Contractor’s Representative and the Construction Representative shall agree monthly on the number of “bad weather” days to be charged against the allowance. This determination will be documented in writing and be signed by the Contractor and the Construction Representatives. If there is a failure to agree on all or part of the “bad weather” days for a particular month, that disagreement shall be noted on this written document and signed by each party’s representative. Failure of the Contractor’s representative to sign the “bad weather” day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the “bad weather” day determination contained in that document.

D. There will be no modification to the time of Contract performance due solely to the failure to deplete the “bad weather” day allowance.

E. Once this allowance is depleted, a no-cost Contract Change time extension will be executed for “bad weather” days, as defined above, encountered during the remainder of the Project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

A. Weather Allowance: Included within the completion period for this Project are 10 “bad weather” days.

END OF SECTION 012100

SECTION 012200 – UNIT PRICES

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.

B. Quantities of Units to be included in the Base Bid are indicated in Section 004322 – Unit Prices.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Unit Prices.

B. Related Sections include the following:

C. First Division 1 Section below contains requirements that relate directly to Unit Prices.
   1. Division 1 Section "Allowances" for procedures for using Unit Prices to adjust quantity allowances.
   2. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Contract Changes.

1.3 DEFINITIONS

A. Unit Price is[an amount proposed by bidders, stated on the Bid Form Attachment 004322] a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit Prices include all necessary material plus cost for delivery, installation, insurance, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of Unit Prices. Methods of measurement and payment for Unit Prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of Work in-place that involves use of established Unit Prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A list of Unit Prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each Unit Price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

A. Unit Price No. 01 – Excavation and Fill:

1. Description: Provide unit cost beyond base bid quantities to over-excavate existing site materials and provide suitable fill for the project including labor, additional material and equipment according to Section 312312 "Subgrade Scarifying, Compaction and Preparation"; Section 312316.16 “Structure Excavation and Backfill”; Section 312333 “Trench Excavation, Backfill and Compaction”; and Appendix A – Geotechnical Report from Olsson dated February 13, 2019.

2. Unit of Measurement: cubic foot.

3. Base Bid Quantity:
   a. Excavation/embankment: 14,500 cubic feet

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Bid Form and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing Alternates.

1.3 DEFINITIONS

A. Definition: An alternate is an amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to the Base Bid amount if the Owner decides to accept a corresponding change in either 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 for each alternate is the net addition to the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

B. No additional time will be allowed for alternate work unless the number of work days is so stated on the Bid Form.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate the Alternate Work into the 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 mentioned as part of the Alternate.

B. Notification: The award of the Contract will indicate whether alternates have been accepted or rejected.

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

D. Schedule: A “Schedule of Alternates” is included at the end of this Section. Specification Sections referenced in the 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

Alternate 1: Provide seamless resinous flooring finishes (epoxy flooring) in the following spaces: Lounge 100, Barracks (1) 101, Barracks (2) 102 and Barracks (3) 105. Provide integral seamless resinous wall base (in conjunction with the floor) at all gypsum board wall locations. Exterior walls with pre-finished metal liner panels shall receive rubber base. Extend seamless resinous flooring material on gypsum board at Janitorial 104, for mop sink backsplash (extent per the Drawings) in lieu of stainless steel.

Base Bid: Locations noted above as part of the Alternate shall receive rubber base and sealed concrete in lieu of the seamless resinous system.

END OF SECTION 012300

SECTION 012600 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract Modifications.

B. Related Sections include the following:

1. Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
2. Section 007213, Article 4.0 "Changes in the Work" for Contract Change requirements.
3. Section 012100 "Allowances" for procedural requirements for handling and processing Allowances.
4. Section 012200 "Unit Prices" for administrative requirements for using Unit Prices.

1.3 REQUESTS FOR INFORMATION

A. In the event that the Contractor or Subcontractor, at any tier, determines that some portion of the Drawings, Specifications, or other Contract Documents requires clarification or interpretation, the Contractor shall submit a Request for Information (RFI) in writing to the Designer. An RFI may only be submitted by the Contractor and shall only be submitted on the RFI forms provided by the Owner. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed. In the RFI, the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

B. Responses to RFIs shall be issued within 10 working days of receipt of the Request from the Contractor unless the Designer determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Designer, the Designer will, within 5 working days of receipt of the request, notify the Contractor of the anticipated response time. If the Contactor submits an RFI on a time-sensitive activity on the current Project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Designer to respond to the request provided that the Designer responds within the 10 working days set forth above.

C. Responses from the Designer will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to an RFI will cause a change to the requirements

of the Contract Documents, the Contractor shall give written notice to the Designer requesting a Contract Change for the work. Failure to give such written notice within 10 working days shall waive the Contractor's right to seek additional time or cost under Article 4, "Changes in the Work" of the General Conditions.

1.4 MINOR CHANGES IN THE WORK

A. Designer will issue Supplemental Instructions authorizing minor changes in the Work, not involving adjustment to the Contract Amount or the Contract Time, on the "Designer's Supplemental Instructions" (DSI).

B. The RFI and DSI forms are included on our website.

1.5 PROPOSAL REQUESTS

A. The Designer or Owner Representative will issue a detailed description of proposed Changes in the Work that may require adjustment to the Contract Amount or the Contract Time. The proposed Change Description will be issued using the Request for Proposal (RFP) form. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by the Designer or Owner Representative are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within 10 working days after receipt of Proposal Request, submit a Proposal for the cost adjustments to the Contract Amount and the Contract Time necessary to execute the Change. The Contractor shall submit his Proposal on the appropriate Contract Change Detailed Breakdown form. Subcontractors may use the appropriate Contract Change Detailed Breakdown form or submit their Proposal on their letterhead provided the same level of detail is included. All Proposals shall include:

   a. A detailed breakdown of costs per Article 4.1 of the General Conditions.
   b. If requesting additional time per Article 4.2 of the General Conditions, include an updated Contractor's Construction Schedule that indicates the effect of the Change including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

1.6 CONTRACT CHANGE PROCEDURES

A. On Owner's approval of a Proposal Request, the Designer or Owner Representative will issue a Contract Change for signatures of Owner and Contractor on the Contract Change form included on our website.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REFERENCED FORMS

A. Request for Information

B. Designer's Supplemental Instructions

C. Request for Proposal

D. Contract Change

END OF SECTION 012600

SECTION 013100 – COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Projects including, but not limited to, the following:

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.

B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific Contractor.

C. Related Sections include the following:

1. Section 007213 "General Conditions"

   a. Articles 1.8,B. and 1.8,C. for coordinating meetings onsite.
   b. Article 5.4,H. for coordinating Closeout of the Contract.

2. Section 013200 "Schedule – Bar Chart" for preparing and submitting Contractor's Construction Schedule.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections, which 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 1 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.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components including mechanical and electrical.

C. 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. Startup and adjustment of systems.
8. 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. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

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.

B. Key Personnel Names: Within 15 work days of starting construction operations, submit a list of key personnel assignments including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and 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. Keep list current at all times.

1.5 PROJECT MEETINGS

A. The Owner's Construction Representative will schedule a Pre-Construction Meeting prior to beginning of construction. The date, time, and exact place of this meeting will be determined after Contract Award and notification of all interested parties. The Contractor shall arrange to have the Job Superintendent and all prime Subcontractors present at the meeting. During the Pre-Construction Meeting, the construction procedures and information necessary for submitting payment requests will be discussed and materials distributed along with any other pertinent information.

1. Minutes: Designer will record and distribute meeting minutes.

B. Progress Meetings: The Owner's Construction Representative will conduct Monthly Progress Meetings as stated in Articles 1.8,B. and 1.8,C. of Section 007213 "General Conditions."

1. Minutes: Designer will record and distribute to Contractor the meeting minutes.

C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Designer and Construction Representative of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration including requirements for the following:

a. Contract Documents
b. Options
c. Related RFIs
d. Related Contract Changes
e. Purchases
f. Deliveries
g. Submittals
h. Review of mockups
i. Possible conflicts
j. Compatibility problems
k. Time schedules
l. Weather limitations
m. Manufacturer's written recommendations
n. Warranty requirements
o. Compatibility of materials
p. Acceptability of substrates
q. Temporary facilities and controls
r. Space and access limitations
s. Regulations of authorities having jurisdiction
t. Testing and inspecting requirements
u. Installation procedures
v. Coordination with other Work

w. Required performance results
x. Protection of adjacent Work
y. Protection of construction and personnel

3. Contractor shall record significant conference discussions, agreements, and disagreements including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
6. Project name
7. Name and address of Contractor
8. Name and address of Designer
9. RFI number including RFIs that were dropped and not submitted
10. RFI description
11. Date the RFI was submitted
12. Date Designer's response was received
13. Identification of related DSI or Proposal Request, as appropriate

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 – SCHEDULE – BAR CHART

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for a Bar Chart Schedule for the Project construction activities, schedule of submittals, and schedule for testing.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

A. The Contractor shall submit to the Designer, within 10 working days following the Notice to Proceed, a Progress Schedule including Schedule of Values showing the rate of progress the Contractor agrees to maintain and the order in which he proposed to carry out the various phases of Work. No payments shall be made to the Contractor until the Progress Schedule has been approved by the Owner.

B. The Contractor shall submit an updated Schedule for presentation at each Monthly Progress Meeting. The Schedule shall be updated by the Contractor as necessary to reflect the current Schedule and its relationship to the original Schedule. The updated Schedule shall reflect any changes in the logic, sequence, durations, or completion date. Payments to the Contractor shall be suspended if the Progress Schedule is not adequately updated to reflect actual conditions.

C. The Contractor shall submit Progress Schedules to Subcontractors to permit coordinating their Progress Schedules to the general construction Work. The Contractor shall coordinate preparation and processing of Schedules and reports with performance of other construction activities.

3.2 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

A. Bar Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor's Construction Schedule. The Contractor for general construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as

significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of "bad" weather days specified in Section 012100 "Allowances."

1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.

    a. If practical, use the same Schedule of Values breakdown for schedule time bars.

2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar shall indicate start and completion dates for the activity. The Contractor shall place a contrasting bar below each original schedule activity time for indicating actual progress and planned remaining duration for the activity.
3. The Contractor shall prepare the Schedule on a minimal number of separate sheets to readily show the data for the entire construction period.
4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on schedule with other construction activities. Include minor elements involved in the overall sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other required schedules and reports.
6. Indicate the Intent to Award and the Contract Substantial Completion dates on the schedule.

B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:

1. Requirement for phased completion
2. Work by separate Contractors
3. Work by the Owner
4. Pre-purchased materials
5. Coordination with existing construction
6. Limitations of continued occupancies
7. Un-interruptible services
8. Partial occupancy prior to Substantial Completion
9. Site restrictions
10. Provisions for future construction
11. Seasonal variations
12. Environmental control

C. Work Stages: Use crosshatched bars to indicate important stages of construction for each major portion of the Work. Such stages include, but are not necessarily limited to, the following:

1. Subcontract awards
2. Submittals
3. Purchases

4. Mock-ups
5. Fabrication
6. Sample testing
7. Deliveries
8. Installation
9. Testing
10. Adjusting
11. Curing
12. Startup and placement into final use and operation

D. Area Separations: Provide a separate time bar to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a "major area" is a story of construction, a separate building, or a similar significant construction element.

1. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion
b. Permanent space enclosure
c. Completion of mechanical installation
d. Completion of the electrical portion of the Work
e. Substantial Completion

3.3 SCHEDULE OF SUBMITTALS

A. Upon acceptance of the Construction Progress Schedule, prepare and submit a complete schedule of submittals. Coordinate the submittal schedule with Section 013300 "Submittals," the approved Construction Progress Schedule, list of subcontracts, Schedule of Values and the list of products.

B. Prepare the schedule in chronological order. Provide the following information:

1. Scheduled date for the first submittal
2. Related Section number
3. Submittal category
4. Name of the subcontractor
5. Description of the part of the Work covered
6. Scheduled date for resubmittal
7. Scheduled date for the Designer's final release or approval

C. Distribution: Following the Designer's response to the initial submittal schedule, print and distribute copies to the Designer, Owner, subcontractors, and other parties required to comply with submittal dates indicated.

1. Post copies in the Project meeting room and temporary field office.
2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

3.4 SCHEDULE OF INSPECTIONS AND TESTS

A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule with 15 days of the date established for commencement of the Contract Work. The Contractor shall notify the testing agency at least 5 working days in advance of the required tests unless otherwise specified.

B. Form: This schedule shall be in tabular form and shall include, but not be limited to, the following:

1. Specification Section number
2. Description of the test
3. Identification of applicable standards
4. Identification of test methods
5. Number of tests required
6. Time schedule or time span for tests
7. Entity responsible for performing tests
8. Requirements for taking samples
9. Unique characteristics of each service

C. Distribution: Distribute the schedule to the Owner, Designer, and each party involved in performance of portions of the Work where inspections and tests are required.

END OF SECTION 013200

SECTION 013300 – SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work including the following:

1. Shop Drawings.
2. Product Data.
3. Samples.
4. Quality Assurance Submittals.
5. Construction Photographs.
6. Operating and Maintenance Manuals.
7. Warranties.

B. Administrative Submittals: Refer to General and Supplementary Conditions other applicable Division 01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Construction Progress Schedule including Schedule of Values.
2. Performance and Payment Bonds.
3. Insurance Certificates.
4. Applications for Payment.
5. Certified Payroll Reports.
6. Partial and Final Receipt of Payment and Release Forms.
7. Affidavit – Compliance with Prevailing Wage Law.
8. Record Drawings.
9. Include all additional administrative submittals required for this Project.
10. Notifications, Permits, etc.

C. The Contractor is obliged and responsible to check all shop drawings and schedules to assure compliance with Contract Plans and Specifications. The Contractor is responsible for the content of the shop drawings and coordination with other Contract work. Shop drawings and schedules shall indicate, in detail, all parts of an Item or Work including erection and setting instructions and integration with the Work of other trades.

D. The Contractor shall at all times make a copy of all approved submittals available on site to the Construction Representative.

1.3 SUBMITTAL PROCEDURES

A. The Contractor shall comply with the General and Supplementary Conditions and other applicable Sections of the Contract Documents. The Contractor shall submit, with such promptness as to cause no delay in his work or in that of any other contractors, all required submittals indicated in Part 3.1 of this Section and elsewhere in the Contract Documents. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

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 elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

a. The Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

B. Each Drawing and/or series of Drawings submitted must be accompanied by a letter of transmittal giving a list of the titles and numbers of the Drawings. Each series shall be numbered consecutively for ready reference and each Drawing shall be marked with the following information:

1. Date of Submission.
2. Name of Project.
3. Location.
4. Section Number of Specification.
5. State Project Number.
6. Name of Submitting Contractor.
7. Name of Subcontractor.
8. Indicate if Item is submitted as specified or as a substitution.

C. Transmission of Submittals: Submittals shall be processed electronically unless otherwise directed.

1. Transmit all submittals from Contractor to Architect using an Electronic Project Management (EPM) system for the organization, distribution, review, tracking and archival of Project documentation including, but not limited to:

a. Product data.
b. Shop drawings.
c. Physical samples (transmittals and/or photographs).
d. Informational submittals.
e. Test data.
f. Photographs.
g. Sample warranties.

2. In addition, the electronic submittal process shall be used for the submission of:

   a. Requests for Information (RFIs).
   b. Contract Changes.
   c. Other submittal types not specifically indicated.

3. Contractor shall also include Project documentation such as:

   a. Construction Drawings.
   b. Specifications.
   c. DSIs.
   d. Related Project documentation.
   e. Appropriate forms as applicable and included in Section 012600 "Contract Modification Procedures."

4. The EPM system shall provide access to all members of the Design Team including, but not limited to the Architect, Structural Engineer, Mechanical/Electrical/Plumbing (MEP) Engineers and others as designated by the Design Team. Access shall be extended to subcontractors on the Project, as well. Disciplines assigned to a specific item shall receive notifications and reminders for their respective discipline along with the Architect.
5. The EPM service shall offer training sessions, video or written instruction on an "as-needed" basis for use of the service.
6. Electronic Project Management System: Subject to compliance with requirements, available services offering a product that may be utilized for use for submittal processes include, but may not be limited to, the following:

   a. Oracle's Primavera Submittal Exchange Cloud Service.
   b. Procore.
   c. PlanGrid, An Autodesk Company.

1.4 SHOP DRAWINGS

A. Comply with the General Conditions, Article 3.2.

B. The Contractor shall submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

C. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings including the following information:

   1. Dimensions.
   2. Identification of products and materials included by Sheet and detail number.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.
   6. Modify subparagraph below to establish a standard sheet size and format.

7. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".

1.5 PRODUCT DATA

A. The Contractor shall comply with the General Conditions, Article 3.2.

B. The Contractor shall collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information including the following information:

a. Manufacturer's printed recommendations.
b. Compliance with Trade Association standards.
c. Compliance with recognized Testing Agency standards.
d. Application of Testing Agency labels and seals.
e. Notation of dimensions verified by field measurement.
f. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.6 SAMPLES

A. The Contractor shall comply with the General Conditions, Article 3.2.

B. The Contractor shall submit full-size, fully fabricated samples, cured and finished as specified, and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

1. The Contractor shall mount or display samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Designer's sample including the following:

a. Specification Section number and reference.
b. Generic description of the Sample.
c. Sample source.
d. Product name or name of the Manufacturer.
e. Compliance with recognized standards.
f. Availability and delivery time.

2. The Contractor shall submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

    a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
    b. Refer to other Specification Sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
    c. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

1.7 QUALITY ASSURANCE DOCUMENTS

A. The Contractor shall comply with the General Conditions, Article 3.2.

B. The Contractor shall submit quality control submittals including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

C. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

    1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to contractually bind the company.

D. Inspection and Test Reports: The Contractor shall submit the required inspection and test reports from independent testing agencies as specified in this Section and in other Sections of the Contract Documents.

E. Construction Photographs: The Contractor shall submit record construction photographs as specified in this Section and in other Sections of the Contract Documents.

    1. The Contractor shall submit digital photographs. The Construction Administrator shall determine the quantity and naming convention at the preconstruction meeting.
    2. The Contractor shall identify each photograph with Project name, location, number, date, time, and orientation.
    3. The Contractor shall submit progress photographs monthly unless specified otherwise. Photographs shall be taken 1 week prior to submitting.
    4. The Contractor shall take 4 site photographs from differing directions and a minimum of 5 interior photographs indicating the relative progress of the Work.

1.8 OPERATING AND MAINTENANCE MANUALS AND WARRANTIES

A. The Contractor shall submit all required manufacturer's operating instructions, maintenance/service manuals, and warranties in accordance with the General Conditions, Article 3.5, and Supplementary Conditions along with this and other Sections of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

A. Contractor shall submit the following information for materials and equipment to be provided under this Contract. Some Descriptions are listed under the "Type of Submittal" which they most closely resemble. This list may not necessarily represent all submittal types and requirements indicated in each specific Specification Section. Contractor shall submit all information required by the Contract Documents whether or not included on this list.

B.

		TYPE OF SUBMITTAL											
SECTION	DESCRIPTION	Shop Drawings	Product Data	Sample	Certifications	Manufacturers Instructions	Test report	Inspection Report	Wiring Diagrams	Record Photographs	Maintenance Data	Operating Instruction	Warranty
013200	Project Schedule			X									
013200	Schedule of Values			X									
015000	Construction Facilities and Temporary Controls				X		X	X					
032000	Concrete Reinforcing	X											
033000	Cast-In-Place Concrete		X				X	X					
042200	Concrete Unit Masonry	X	X				X	X					
051200	Structural Steel Framing	X											
053000	Steel Decking	X	X										

		TYPE OF SUBMITTAL											
SECTION	DESCRIPTION	Shop Drawings	Product Data	Sample	Certifications	Manufacturers Instructions	Test report	Inspection Report	Wiring Diagrams	Record Photographs	Maintenance Data	Operating Instruction	Warranty
055000	Metal Fabrications	X	X		X								
061053	Miscellaneous Rough Carpentry		X		X								
072100	Thermal Insulation		X				X						
077253	Snow Guards		X	X				X					
078413	Penetration Firestopping		X		X								
079200	Joint Sealants		X	X	X			X					X
081113	Hollow Metal Doors and Frames	X	X	X			X						
081416	Flush Wood Doors	X	X	X	X			X					X
083113	Access Doors and Frames	X	X	X									
084213	Aluminum-Framed Entrances	X	X	X	X		X	X			X		X
085113	Aluminum Windows	X	X	X	X		X	X					X
087100	Door Hardware	X	X	X			X	X			X		X
088000	Glazing		X	X	X		X						X
083990	Tornado-Resistant Steel Doors and Frames	X	X		X		X						X
092216	Non-Structural Metal Framing		X		X								
092900	Gypsum Board		X	X									
095113	Acoustical Panel Ceilings		X	X	X		X	X					
096513	Resilient Base and Accessories		X	X									
096566	Resilient Athletic Flooring	X	X	X							X		
096723	Resinous Flooring		X	X	X								X
099113	Exterior Painting		X	X									

		TYPE OF SUBMITTAL											
SECTION	DESCRIPTION	Shop Drawings	Product Data	Sample	Certifications	Manufacturers Instructions	Test report	Inspection Report	Wiring Diagrams	Record Photographs	Maintenance Data	Operating Instruction	Warranty
099123	Interior Painting		X	X									
099600	High-Performance Coatings (EPW1)		X	X									
102113.19	Plastic Toilet Compartments	X	X	X							X		
102600	Wall and Door Protection	X	X	X									X
102800	Toilet, Bath, and Laundry Accessories		X										X
104413	Fire Protection Cabinets	X	X	X							X		
104416	Fire Extinguishers		X								X	X	X
105113	Metal Lockers	X	X	X							X		X
122413	Roller Window Shades	X	X								X	X	X
123661.16	Solid-Surfacing Countertops	X	X	X							X	X	
133419	Metal Building Systems	X	X	X	X			X			X		X
210514	Services		X										
210516	Expansion Compensators		X										
210517	Firestopping for Fire Suppression Systems	X	X		X	X							
210519	Meters and Gauges		X										
210523	Piping Specialties and Valves		X										
210529	Piping Supports, Anchors, and Seals		X										
210553	Fire Protection Identification		X										
211100	Pipe and Fittings		X										
211300	Wet Sprinkler System	X	X		X						X	X	X

		TYPE OF SUBMITTAL											
SECTION	DESCRIPTION	Shop Drawings	Product Data	Sample	Certifications	Manufacturers Instructions	Test report	Inspection Report	Wiring Diagrams	Record Photographs	Maintenance Data	Operating Instruction	Warranty
220514	Services		X										
220516	Expansion Compensators		X										
220517	Firestopping for Plumbing Systems	X	X		X	X							
220519	Meters and Gauges		X										
220523	Piping Specialties and Valves		X										
220529	Piping Supports, Anchors and Seals		X										
220548	Vibration Isolators		X										
220553	Plumbing Identification		X										
220716	Plumbing Insulation		X										
221100	Domestic Water Pipe and Fittings		X										
221115	Natural Gas Piping and Fittings		X										
221119	Domestic Water Specialties		X										
221123	Domestic Water Pumps		X								X	X	X
221300	Sanitary Pipe and Fittings		X										
221319	Sanitary Specialties		X										
223400	Gas-Fired Water Heaters		X								X	X	X
224200	Plumbing Fixtures and Trim		X										
230517	Fire Stopping for HVAC Systems	X	X		X	X							
230529	Piping Supports, Anchors and Seals		X										
230550	Testing and Adjusting		X										

		TYPE OF SUBMITTAL											
SECTION	DESCRIPTION	Shop Drawings	Product Data	Sample	Certifications	Manufacturers Instructions	Test report	Inspection Report	Wiring Diagrams	Record Photographs	Maintenance Data	Operating Instruction	Warranty
230553	HVAC Identification		X										
230713	Duct Insulation		X										
230719	HVAC Piping Insulation		X										
232300	Refrigerant Piping and Fittings		X										
233113	Metal Ducts		X										
233300	Duct Accessories		X										
233416	Air Distribution Equipment		X										
233713	Grilles, Registers, Diffusers, and Louvers		X										
235413	Gas-Fired Furnaces		X								X	X	X
236215	Air-Cooled Condensing Units		X								X	X	X
260114	Electrical Service		X										
260117	Firestopping for Electrical Systems	X	X		X	X							
260515	Low-Voltage Power Conductors and Cables		X										
260526	Grounding and Bonding		X										
260533	Above-Ground Raceways and Boxes		X										
260553	Electrical Identification		X										
260939	Lighting Control Devices		X										
262416	Panelboards		X										
262726	Wiring Devices		X										
262816	Safety Switches		X										
264113	Lightning Protection System	X	X		X	X							

		TYPE OF SUBMITTAL											
SECTION	DESCRIPTION	Shop Drawings	Product Data	Sample	Certifications	Manufacturers Instructions	Test report	Inspection Report	Wiring Diagrams	Record Photographs	Maintenance Data	Operating Instruction	Warranty
264313	Surge Protective Devices (Transient Voltage Surge Suppressor)		X										
265113	Interior Lighting		X								X	X	X
265613	Exterior Lighting		X								X	X	X
270117	Through-Penetration Firestopping	X	X		X	X							
270526	Grounding and Bonding		X										
270533	Above-Ground Raceways and Boxes		X										
270553	Communications Identification		X										
272013	Data/Phone System Requirements		X										
272015	Data/Phone System Structured Cabling		X										
280117	Through-Penetration Firestopping	X	X		X	X							
280515	Fire Alarm Conductors and Cables		X										
280526	Grounding and Bonding		X										
280533	Above-Ground Raceways and Boxes		X										
283101	Fire Alarm System	X	X		X	X					X	X	X
312313	Subgrade Scarifying, Compaction, and Preparation						X						
321123	Aggregate Base Course						X						

		TYPE OF SUBMITTAL											
SECTION	DESCRIPTION	Shop Drawings	Product Data	Sample	Certifications	Manufacturers Instructions	Test report	Inspection Report	Wiring Diagrams	Record Photographs	Maintenance Data	Operating Instruction	Warranty
321623	Sidewalks and Exterior Slabs		X				X						
329200	Seeding and Sodding		X		X								
331113	Water Utility Distribution Piping		X				X						
333113	Gravity Sewer Line		X				X						
334113	Drainage Pipe and Culverts		X		X								

END OF SECTION 013300

SECTION 013513.28 – SITE SECURITY AND HEALTH REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 01 Specification Sections apply to this Section.

1.2 SUBMITTALS

A. List of Required Submittals:

1. Materials Safety Data Sheets for all hazardous materials to be brought onsite.
2. Schedule of proposed shutdowns, if applicable.
3. Required fingerprinting for criminal background and warrants check. A list of the names of all employees who will submit fingerprints for a background check and the signed privacy documents identified below for each employee.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCESS TO THE SITE

A. The Contractor shall arrange with the Construction Representative and appropriate Facility Representatives for the controlled entry of construction personnel, materials, and equipment into the work areas.

B. The Contractor shall establish regular working hours with the Construction Representative and the Facility. Working hour changes or overtime shall be reported and approved 48 hours ahead of time. Emergency overtime shall be reported as soon as it is evident that overtime is needed.

C. The Contractor shall provide the name and phone number of the individual(s) who is in charge onsite and who can be contacted in case of an emergency. This individual(s) must be able to furnish names and addresses of all construction personnel upon request.

D. All construction personnel shall be identified to the Facility Representative and, when the Facility Representative feels it is necessary, they will be issued identification cards.

3.2 FIRE PROTECTION, SAFETY, AND HEALTH CONTROLS

A. The Contractor shall be responsible and take all necessary precautions to guard against and eliminate possible fire hazards. Onsite burning is prohibited.

B. Store all flammable or hazardous materials in proper container located outside the buildings or offsite, if possible.

C. Provide and maintain in good order, during construction, all fire extinguishers as required by the National Fire Protection Association. In areas of flammable liquids, asphalt, or electrical hazards, extinguishers of the 15-pound carbon dioxide type or 20-pound dry chemical type shall be provided.

D. Fire exits, alarm systems, and sprinkler systems shall remain fully operational at all times unless written approval is received from the Construction Representative and the appropriate Facility Representative at least 24 hours in advance. The Contractor shall submit a written time schedule for any proposed shutdowns.

E. Conduct operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent facilities. Do not obstruct streets or walks or use facilities without permission from the Facility.

F. Construction personnel shall not exceed the Facility speed limit of 15 mph unless posted otherwise.

G. Take all necessary reasonable measures to reduce air and water pollution by any material or equipment use during construction. Keep volatile wastes in covered containers. Do not dispose of volatile wastes or oils in storm or sanitary drains.

H. Keep Project neat, orderly, and in a safe condition at all times. Immediately remove all hazardous waste. Do not allow rubbish to accumulate. Provide onsite containers for collection of rubbish and dispose of it at frequent intervals during progress of Work.

I. For all hazardous materials brought onsite, Material Safety Data Sheets shall be on site and readily available upon request at least a day before delivery.

J. Intoxicating beverages or narcotics shall not be brought upon the premises nor shall Contractor's personnel be under the influence of these substances while on the premises.

3.3 DISRUPTION OF UTILITIES

A. The Contractor shall give minimum 72 hours' written notice to the Construction Representative and Facility Representative before disconnecting electric, gas, water, fire protection, or sewer service to any building.

B. The Contractor shall give minimum 72 hours' written notice to the Construction Representative and Facility Representative before closing any access drives and shall make temporary access available if possible. Do not obstruct streets, walks, or parking.

3.4 REQUIRED FINGERPRINTING FOR CRIMINAL BACKGROUND AND WARRANTS CHECK

A. All employees of the Contractor are required to submit fingerprints to the Missouri State Highway Patrol to enable the Office of Administration, Division of Facilities Management, Design and Construction (FMDC) to receive State and National criminal background checks on such employees. FMDC will also check with law enforcement to determine if any of the Contractor's employees has an outstanding warrant for his or her arrest. FMDC reserves the right to prohibit any employee of the Contractor from performing work in or on the premises of any facility owned, operated, or utilized by the State of Missouri for any reason.

B. The Contractor shall ensure all of its employees submit fingerprints to the Missouri State Highway Patrol and pay for the cost of such background checks. The Contractor shall submit to FMDC a list of the names of the Contractor's employees who will be fingerprinted and a signed Missouri Applicant Fingerprint Privacy Notice, Applicant Privacy Rights and Privacy Act Statement for each employee. All employees of the Contractor approved by FMDC to work at a State facility must obtain a contractor ID badge from FMDC prior to beginning work on-site, unless the Director of FMDC, at the Director's discretion, waives the requirement for a contractor ID badge. The Contractor and its employees must comply with the process for background checks and contractor ID badges found on FMDC's website at: https://oa.mo.gov/fmdc-contractor-id-badges

C. Pursuant to section 43.540, RSMo, FMDC participates in the Missouri Rap Back and National Rap Back programs as of August 28, 2018. This means that the Missouri State Highway Patrol, Central Records Repository, and the Federal Bureau of Investigation will retain the fingerprints submitted by each of the Contractor's employees, and those fingerprints will be searched against other fingerprints on file, including latent fingerprints. While retained, an employee's fingerprints may continue to be compared against other fingerprints submitted or retained by the Federal Bureau of Investigation, including latent fingerprints.

D. As part of the Missouri and National Rap Back programs, FMDC will receive notification if a new arrest is reported for an employee whose fingerprints have been submitted for FMDC after August 28, 2018. If the employee is performing work on a State contract at the time of the arrest notification, FMDC will request and receive the employee's updated criminal history records. If the employee is no longer performing work on a State contract, FMDC will not obtain updated criminal records.

E. Pursuant to section 43.540, RSMo, the Missouri State Highway Patrol will provide the results of the employee's background check directly to FMDC. FMDC may NOT release the results of a background check to the Contractor or provide the Contractor any information obtained from a background check, either verbally or in writing. FMDC will notify the Contractor only whether an employee is approved to work on State property.

F. Each employee who submits fingerprints to the Missouri State Highway Patrol has a right to obtain a copy of the results of his or her background check. The employee may challenge the accuracy and completeness of the information contained in a background check report and obtain a determination from the Missouri State Highway Patrol and/or the FBI regarding the validity of such challenge prior to FMDC making a final decision about his or her eligibility to perform work under a State contract.

G. The Contractor shall notify FMDC if an employee is terminated or resigns from employment with the Contractor. If the Contractor does not anticipate performing work on a State contract in the future, the Contractor may request that FMDC remove its employees from the Rap Back programs. However, if removed from the Rap Back programs, employees will be required to submit new fingerprints should the Contractor be awarded another State contract.

H. Upon award of a Contract, the Contractor should contact FMDC to determine if its employees need to provide a new background check. If a Contractor's employee has previously submitted a fingerprint background check to FMDC as part of the Missouri and National Rap Back programs, the employee may not need to submit another fingerprint search for a period of 3 to 6 years, depending upon the circumstances. The Contractor understands and agrees that FMDC may require more frequent background checks without providing any explanation to the Contractor. The fact that an additional background check is requested by FMDC does not indicate that the employee has a criminal record.

END OF SECTION 013513.28

SECTION 014000 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection 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-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of 5 previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for 1 or more of the following:
   a. Verify selections made under Sample submittals.
   b. Demonstrate aesthetic effects.
   c. Demonstrate the qualities of products and workmanship.
   d. Demonstrate successful installation of interfaces between components and systems.
   e. Perform preconstruction testing to determine system performance.
2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.4 DELEGATED-DESIGN SERVICES

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.

B. Delegated-Design Services Statement: 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.

1.5 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with 2 or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. 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 within reasonable limits. 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.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: 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.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.

5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, 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 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than 5 days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Inspection of Workmanship: Describe process for inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements.

F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction and/or the Owner.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address 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. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
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.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical 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 of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.

3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. 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, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. 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.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, 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.

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 is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections 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 in the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:

1. Provide test specimens representative of proposed products and construction.
2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
4. 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.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect 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. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. 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 as specified in Section 013300 "Submittals."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives 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 inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.

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 inspection.

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 and/or as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Contractor shall submit information for all third-party firms to the Architect and/or Engineers for review and approval.

B. Special Tests and Inspections: Contractor shall engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction, as required by the Plans and Specifications, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

C. Special Tests and Inspections: Architect shall engage a qualified and registered design professional for structural observations as outlined in Chapter 1 of the 2014 ICC 500/NSSA Standard for the Design and Construction of Storm Shelters.

1. Contractor to coordinate construction site visits with the designated design professional for specific milestones as required by the building code.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

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 014000

SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

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

B. Temporary utilities include, but are not limited to, the following:

1. Water service and distribution
2. Temporary electric power and light
3. Temporary heat
4. Ventilation
5. Telephone service
6. Sanitary facilities, including drinking water
7. Storm and sanitary sewer

C. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds
2. Temporary roads and paving
3. Dewatering facilities and drains
4. Temporary enclosures
5. Waste disposal services
6. Rodent and pest control
7. Construction aids and miscellaneous services and facilities

D. Security and protection facilities include, but are not limited to, to following:

1. Temporary fire protection
2. Barricades, warning signs, and lights
3. Enclosure fence for the site
4. Environmental protection

1.3 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

B. Implementation and Termination Schedule: Within 15 days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:

1. Building code requirements
2. Health and safety regulations
3. Utility company regulations
4. Police, fire department, and rescue squad rules
5. Environmental protection regulations

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations." ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."

1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.
3. For fences and vision barriers, provide minimum 3/9-inch-thick exterior plywood.
4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-thick exterior plywood.

C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.

D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary office, shops, and shed.

E. Paint: Comply with requirements of Division 09 Sections "Exterior Painting" and "Interior Painting."

1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade, acrylic-latex emulsion over exterior primer.
2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
3. For interior walls of temporary offices, provide 2 quarts interior latex-flat wall paint.

F. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

G. Water: Provide potable water approved by local health authorities.

H. Open-Mesh Fencing: Provide 0.120-inch-thick, galvanized 2-inch chain-link fabric fencing 6 inches high with galvanized barbed-wire top strand and galvanized steel pipe posts, 1-1/2 inches ID for line posts and 2-1/2 inches ID for corner posts.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Designer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4-inch, heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110V to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage rating.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixture where exposed to moisture.

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.

G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

I. 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 NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each Facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Contract Change.

B. Temporary Water Service: The Owner will provide water for construction purposes from the existing building system. All required temporary extensions shall be provided and removed by the Contractor. Connection points and methods of connection shall be designated and approved by the Construction Representative.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.

1. Install electric power service underground, except where overhead service must be used.
2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125V, AC 20-ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.

1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

E. Temporary Heating: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

1. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP gas or fuel-oil heaters with individual space thermostatic control.
2. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

F. Temporary Toilets: Install self-contained toilet units. Use of pit-type privies will not be permitted. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.

1. Shield toilets to ensure privacy.
2. Provide toilet tissue materials for each facility.

G. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a health and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

1. Provide paper towels or similar disposable materials for each facility.
2. Provide covered waste containers for used material.
3. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

H. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.

1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 degrees F to 55 degrees F.

I. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip office as follows:

1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.
2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.

C. Storage Facilities: Install storage sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces onsite. Specific locations for storage will be discussed at the Pre-Bid Meeting and the Pre-Construction Meeting.

D. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Designer.

1. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of gravel base of permanent paving.
2. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
3. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.

E. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.

F. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations associated with construction activities, where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

1. Where heat is needed, and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.
2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Where temporary wood or plywood enclosure exceeds 100 square feet in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

H. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.

I. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 degrees F. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

J. Rodent Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures are regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

K. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Designer.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonable predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than 1 extinguisher for each floor.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

C. Permanent Fire Protection: At the earliest feasible date in each area of the Project complete installation of the permanent fire-protection facility including connected services and place into operation and use. Instruct key personnel on use of facilities.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.

E. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Designer requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

   a. Replace air filters and clean inside of ductwork and housing.
   b. Replace significantly worn parts and parts subject to unusual operating conditions.
   c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 015000

SECTION 017400 – CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for cleaning during the Project.

B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.

1. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator for the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:

1. Retain all stored items in an orderly arrangement allowing maximum access, not impending drainage or traffic, and providing the required protection of materials.
2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the jobsite.

4. Provide adequate storage for all items awaiting removal from the jobsite, observing all requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, inspect all arrangements of materials stored onsite. Re-stack, tidy, or otherwise service all material arrangements.
3. Maintain the site in a neat and orderly condition at all times.

C. Structures:

1. Daily: Inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly: Sweep all interior spaces clean. "Clean" for the purposes of this subparagraph shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.
3. In preparation for installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily while work is being performed in the space in which finish materials have been installed. "Clean" for the purposes of this subparagraph shall be interpreted as meaning free from all foreign material which, in the opinion of the Construction Representative, may be injurious to the finish of the finish floor material.

3.2 FINAL CLEANING

A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.

1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities including landscape development areas, of rubbish, waste material, litter, and foreign substances.
2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
3. Remove petrochemical spills, stains, and other foreign deposits.
4. Remove tools, construction equipment, machinery, and surplus material from the site.
5. Remove snow and ice to provide safe access to the building.

6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
8. Broom clean concrete floors in unoccupied spaces.
9. Vacuum clean carpet and similar soft surfaces removing debris and excess nap. Shampoo, if required.
10. Clean transparent material, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
11. Remove labels that are not permanent labels.
12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

13. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
14. Clean plumbing fixtures to a sanitary condition free of stains, including stains resulting from water exposure.
15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
16. Clean ducts, blowers, and coils if units were operated without filters during construction.
17. Clean food-service equipment to a sanitary condition, ready and acceptable for its intended use.
18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
19. Leave the Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.

D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.

E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner's property.

END OF SECTION 017400

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Recycling nonhazardous demolition and construction waste.
   2. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

   1. All applicable specification sections.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.4 PERFORMANCE REQUIREMENTS

A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials**,** including the following:

   1. Demolition Waste:

      a. Concrete.
      b. Concrete reinforcing steel.
      c. Brick.
      d. Concrete masonry units.
      e. Metal Roofing.
      f. Windows.
      g. Electrical conduit.
      h. Copper wiring.

2. Construction Waste:

   a. Masonry and CMU.
   b. Metals.
   c. Metal Roofing.
   d. Insulation.
   e. Piping.
   f. Electrical conduit.
   g. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

      1) Paper.
      2) Cardboard.
      3) Boxes.
      4) Plastic sheet and film.
      5) Polystyrene packaging.
      6) Wood crates.
      7) Plastic pails.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 00 and 01. Review methods and procedures related to waste management including, but not limited to, the following:

   1. Review and discuss waste management plan including responsibilities of waste management coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
   4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   5. Review waste management requirements for each trade.

1.6 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept.
2. Disposed Materials: Indicate how and where materials will be disposed of.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within 10 days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, or disposed of.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 DISPOSAL OF WASTE

A. General: Presidential Executive Order 13514 “Federal Leadership in Environmental, Energy, and Economic Performance”, 8 October, 2009 previously required the diversion of at least 50% by weight of all construction and demolition materials and debris by the end of fiscal year 2015. Therefore, the Contractor shall make all reasonable efforts to recycle and recover Construction and Demolition (C&D) waste from this project. Records shall be maintained to document the quantity of waste generated, the quantity of waste diverted through sale, reuse, or recycling, and the quantity of waste disposed of by landfill or incineration.

1. All records must be provided to the project manager upon project completion.

B. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C. Burning: Do not burn waste materials.

D. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

a. Plywood, metal, or other approved panel materials.

2.2 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

C. Limit concrete surface irregularities as follows:

1. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Do not use rust-stained, steel, form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips.
2. Use strike-off templates or compacting-type screeds.

G. Chamfer exterior corners and edges of permanently exposed concrete.

H. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

J. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 ACTION SUBMITTALS

A. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

B. Mechanical Splice Couplers: ACI 318 Type 2, same material of reinforcing bar being spliced;.

C. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318 or as indicated in Structural General Notes.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 48 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
9. Intended placement method.
10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

B. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.6 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I.
2. Fly Ash: ASTM C618, Class C or F.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.

E. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, having the following properties:

1. Maximum permeance 0.01 ppm
2. Minimum thickness of 15 mils
3. Stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs.
4. Single-ply polyethylene is prohibited.

2.4 CURING MATERIALS

A. Water: Potable or complying with ASTM C1602/C1602M.

B. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

2.5 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 15 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.

2.6 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.

1. Exposure Class: ACI 318 F1 S0 C1.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.50.
4. Slump Limit: 4 inches, plus or minus 1 inch.

B. Class C: Normal-weight concrete used for interior slabs-on-ground.

1. Exposure Class: ACI 318 F0 S0 C1.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content:

a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

C. Class X : Normal-weight concrete used for exterior slabs and walls.

1. Exposure Class: ACI 318 F3 S0 C2.
2. Minimum Compressive Strength: 4500 psi at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content:

a. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.2 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.3 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls 12'-0" on center. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

3.4 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.5 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
b. Remove projections larger than 1 inch.
c. Tie holes do not require patching.
d. Surface Tolerance: ACI 117 Class D.
e. Apply to concrete surfaces not exposed to public view .

2. ACI 301Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
b. Remove projections larger than 1/4 inch.
c. Patch tie holes.
d. Surface Tolerance: ACI 117 Class B.
e. Locations: Apply to concrete surfaces exposed to public view, .

3.6 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view.
7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Drawings. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.8 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    d. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12-inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

b. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

c. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.9 TOLERANCES

A. Conform to ACI 117.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.
2) Name of testing agency.
3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.
8) Date and time sample was obtained.
9) Truck and batch ticket numbers.
10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results.
13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at seven days and 28 days.

B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

   a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;.

   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

   a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31/C31M:

   a. Cast and laboratory cure one set of five 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39/C39M.

a. Test one laboratory-cured specimen at seven days and three specimens at 28 days. Hold one specimen to be tested later, if required.
b. A compressive-strength test shall be the average compressive strength from a set of two 6 by 12 or three 4 by 8 specimens obtained from same composite sample and tested at age indicated.

7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
9. Additional Tests:

a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.

10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.11 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Steel reinforcing bars.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product. For masonry units, include material test reports substantiating compliance with requirements.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.5 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3250 psi .
2. Density Classification: Normal weight .

2.3 CONCRETE LINTELS

A. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.

2.4 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M.

B. Aggregate for Mortar: ASTM C144.

1. White-Mortar Aggregates: Natural white sand or crushed white stone.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

C. Aggregate for Grout: ASTM C404.

D. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Mill- galvanized, carbon steel.
2. Wire Size for Side Rods: 0.148-inch diameter.
3. Wire Size for Cross Rods: 0.148-inch diameter.
4. Spacing of Cross Rods: Not more than 16 inches o.c.
5. Provide in lengths of not less than 10 feet , with prefabricated corner and tee units.

2.6 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use masonry cement mortar unless otherwise indicated.
3. For reinforced masonry, use masonry cement mortar.
4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For reinforced masonry, use Type S .

D. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2500 psi .
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.7 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 64 inches .

3.8 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contactor shall engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

I. Prism Test: For each type of construction provided, according to ASTM C1314 at seven days and at 28 days.

3.9 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.10 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shear stud connectors.
3. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

B. Snug Tightened Joint: (AISC/RCSC) A joint in which the bolts have been installed in accordance with Section 8.1 (RCSC). The snug tightened condition is the tightness that is attained with a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench to bring the plies into firm contact

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication of structural-steel components.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.

2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

B. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36 .

1. Configuration: Straight.
2. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

B. Headed Anchor Rods: ASTM F1554, Grade 36 , straight.

1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

C. Threaded Rods: ASTM A36/A36M .

1. Finish: Plain .

2.5 PRIMER

A. Steel Primer:

1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

B. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Galvanized surfaces.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 3.

C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

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

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Composite floor deck.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Composite floor deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 COMPOSITE FLOOR DECK

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

1. New Millennium Building Systems, LLC.
2. Nucor Corp.
3. Verco Decking, Inc., a Nucor company.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Profile Depth: 2 inches .
3. Design Uncoated-Steel Thickness: 0.0474 inch .

2.3 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

C. Galvanizing Repair Paint: ASTM A780/A780M .

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

C. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

D. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

E. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

G. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

H. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.2 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION 053100

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 countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.

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

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

C. Related Requirements: Section 133419 "Metal Building Systems" for steel framing, supports and other steel items attached to the structural-steel framing.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Fasteners.

2. Shop primers.
3. Shrinkage-resisting grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Metal floor plate and supports.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator, special inspector and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Research Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. 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 degrees F, ambient; 180 degrees F, material surfaces.

2.2 METALS

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.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. stainless-steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

D. Stainless-Steel Bars and Shapes: ASTM A276/A276M, Type 304.

E. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

F. Rolled-Stainless-Steel Floor Plate: ASTM A793.

G. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

H. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

I. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening stainless-steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as

determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. 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.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3,000 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 are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8- by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches on center, 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. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 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 and prime exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with zinc-rich primer

2.8 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 2 integrally welded steel strap anchors for embedding in concrete.

2.9 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer.
2. Shop prime exterior items with zinc-rich primer.

D. Preparation for Shop Priming: Prepare surfaces to comply with 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. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for overhead doors (as indicated on the Drawings) securely to, and rigidly brace from, building structure.

3.3 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

   a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

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. Framing with dimension lumber.
2. Wood blocking and nailers.
3. Wood furring.
4. Plywood backing panels.

1.3 REFERENCED STANDARDS

A. American Forest and Paper Association

B. American Plywood Association

C. National Association of Home Builders

D. Western Wood Products Association

E. Southern Forest Products Association

F. American Lumber Standards Committee

1.4 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Provide lumber in species, grades and sizes appropriate for intended use. Comply with standards published by associations having jurisdiction on species type.

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to masonry or concrete walls.
4. Wood installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Furring.

B. Dimension Lumber Items: any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Concealed Boards: 19 percent maximum moisture content of any of the following species and grades:

1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Panel Products:

1. Plywood: Acceptable Uses: Wall and roof sheathing, subflooring, underlayment, backing and blocking. Provide APA performance-rated panels for type, exposure, and thickness appropriate to applications.
2. Particleboard: Acceptable Uses: Underlayment, subflooring, and wall sheathing. Provide APA performance-rated panels for type, exposure and thickness appropriate to applications.
3. Hardboard: Acceptable Uses: Underlayment.
4. Waferboard: Use is discouraged except in special applications.
5. Oriented Strand Board (OSB): Use is discouraged except in special applications.

B. Provide APA performance-rated panels for type, exposure and thickness appropriate to applications.

C. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

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

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening to Metal Framing: ASTM C1002, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors:

1. Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on:

a. ICC-ES AC01 for mechanical fasteners in masonry.
b. ICC-ES AC58 for adhesive anchors in masonry.
c. ICC-ES AC193 for mechanical fasteners in concrete.
d. ICC-ES AC308 for adhesive anchors in concrete as appropriate for the substrate.

2. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

2.7 METAL FRAMING ANCHORS

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

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong Tie Co., Inc.
5. USP Structural Connectors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036-inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Flexible Flashing (Bond Breaker): Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025-inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches on center.

F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install wood blocking within all stud walls (metal or wood) for the attachment of trims, toilet accessories, toilet partitions, or any accessories to be attached to hollow walls.

B. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

C. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches on center.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 072100 - THERMAL INSULATION

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. Extruded polystyrene foam-plastic board.
2. Molded polystyrene foam-plastic board.
3. Polyisocyanurate foam-plastic board.
4. Glass-fiber blanket.
5. Mineral-wool blanket.

B. Related Requirements: Section 133419 “Metal Building Systems” for exterior envelope insulation included as part of the pre-engineered metal building package.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to 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 foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.

3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded Polystyrene Board, Type IV (Under-Slab Perimeter Insulation): ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.

1. DiversiFoam Products.
2. Dow Chemical Company (The).
3. Kingspan Insulation Limited.
4. Owens Corning.

2.2 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Unfaced (Concealed Locations at Interior Partitions): ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

1. CertainTeed Corporation.
2. Johns Manville; A Berkshire Hathaway company.
3. Knauf Insulation.
4. Owens Corning.

B. Glass-Fiber Blanket Kraft-Faced (Exterior Wall Locations Where A Vapor Retarder Is Required): ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

1. CertainTeed Corporation.
2. Johns Manville; A Berkshire Hathaway company.
3. Knauf Insulation.
4. Owens Corning.

C. Glass-Fiber Blanket Foil Faced (Locations Where Insulation Is Exposed): ASTM C665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

1. CertainTeed Corporation.
2. Johns Manville; A Berkshire Hathaway company.
3. Knauf Insulation.
4. Owens Corning.

2.3 MINERAL-WOOL BLANKETS

A. Mineral-Wool Blanket, Unfaced (as indicated per Drawings): ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

1. Johns Manville; A Berkshire Hathaway company.
2. Rockwool International.
3. Thermafiber; An Owens Corning company.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than 1 length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward interior of construction.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lbs./cu. ft.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 077253 - SNOW GUARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

Section Includes: Rail-type, seam-mounted snow guards.

1.3 ACTION SUBMITTALS

Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for snow guards.

Shop Drawings: Include attachment details of snow guards.

1. Include details of rail-type snow guards.
2. Include calculation of number of snow guards based on snow load, roof slope, roof type, components, spacings, and finish.

Samples: Base, bracket, and 12-inch-long rail.

1.4 INFORMATIONAL SUBMITTALS

Product Test Reports: For each type of snow guard, for tests performed by manufacturer and witnessed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Temperature Change: 200 degrees F.

Structural Performance:

1. Snow Loads: As indicated on Drawings.

2.2 RAIL-TYPE SNOW GUARDS

Seam-Mounted, Rail-Type Snow Guards for Use on Standing-Seam Metal Roof Panels:

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

   LMCurbs.
   b. Metal Roof Innovations, Ltd.; S-5! Attachment Solutions.
   c. Snow Management Systems; a division of Contek, Inc.

2. Description: Snow guardrails fabricated from extrusions, anchored to brackets and equipped with color-matching insert matching material and finish used for metal roofing.

   Between roof seams, system is to include components capable of retarding the migration of snow beneath the main rail. Components shall extend from rail system to metal roof pan and include integrated rubber pads to prevent abrasion of roof panel finish.

3. Material and Finish: Match roof.

   Finish color shall match roof color for life of the roof.

PART 3 - EXECUTION

3.1 EXAMINATION

Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates including compatibility with existing finishes or primers.

Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Clean and prepare substrates for bonding snow guards.

Prime substrates according to snow guard manufacturer's written instructions.

3.3 INSTALLATION

Install snow guards in locations indicated on Drawings according to manufacturer's written instructions. Where not indicated on Drawings, the following shall still apply:

1. Provide length, quantity and spacing of snow guards and snow migration retarding components and number of rows as recommended by manufacturer for Project snow loads and roof seam spacing or as indicated on Drawings, whichever is greater.
2. Snow guards shall extend past both sides of door openings a minimum of 4'-0".
3. Where pavement or gravel (sidewalks, drives, aprons, etc.) abuts exterior building walls, snow guard coverage shall equal length of abutting pavement.

Attachment for Standing-Seam Metal Roofing:

1. Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty.
2. Seam-Mounted, Rail-Type Snow Guards: Stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels.

END OF SECTION 077253

SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Requirements: Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction and smoke barriers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

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

1. 3M Fire Protection Products.
2. A/D Fire Protection Systems.
3. Construction Solutions.
4. Grabber Construction Products.
5. Hilti, Inc.
6. Holdrite; Reliance Worldwide Company.
7. NUCO Inc.
8. Passive Fire Protection Partners.
9. Specified Technologies, Inc.
10. STC Sound Control.
11. Tremco, Inc.

C. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

D. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.

E. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50 cfm cumulative total for any 100 square feet at both ambient and elevated temperatures.

F. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 FILL MATERIALS

A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on 1 side.

F. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

G. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

H. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
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 the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and

remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

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: Joints in or between fire-resistance-rated constructions.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls.
2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2) Intertek Group in its "Directory of Listed Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

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

    a. 3M Fire Protection Products.
    b. A/D Fire Protection Systems Inc.
    c. Grabber Construction Products.
    d. Hilti, Inc.
    e. Nelson Firestop; a brand of Emerson Industrial Automation.
    f. NUCO Inc.
    g. Passive Fire Protection Partners.
    h. RectorSeal.
    i. ROCKWOOL (ROXUL Inc.).
    j. Specified Technologies, Inc.
    k. Thermafiber, Inc.; an Owens Corning company.
    l. Tremco, Inc.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

3.5 JOINT FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.

END OF SECTION 078443

SECTION 079200 - JOINT SEALANTS

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.

B. Related Requirements:

1. Section 078413 “Penetration Firestopping” for penetrations in fire-resistance-rated walls.
2. Section 078443 “Joint Firestopping” for joints in or between fire-resistance-rated construction and smoke barriers.

1.2 SUMMARY

A. Section Includes:

1. Non-staining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

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.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

D. Field-Adhesion-Test Reports: For each sealant application tested.

E. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 FIELD CONDITIONS

A. 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 joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace 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.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from 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 JOINT SEALANTS, 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 joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Non-staining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Non-staining, S, NS, 50, NT: Non-staining, single-component, non-sag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

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

    a. GE Construction Sealants; Momentive Performance Materials Inc.
    b. Pecora Corporation.
    c. Sika Corporation; Joint Sealants.
    d. The Dow Chemical Company.
    e. Tremco Incorporated.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, non-sag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

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

    a. BASF Corporation.
    b. Bostik, Inc.
    c. Pecora Corporation.
    d. Sherwin Williams Company (The).
    e. Sika Corporation; Joint Sealants.
    f. Tremco Incorporated.

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

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

    a. BASF Corporation.
    b. Pecora Corporation.
    c. Sherwin Williams Company (The).

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

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

    a. GE Construction Sealants; Momentive Performance Materials Inc.
    b. Pecora Corporation.
    c. The Dow Chemical Company.
    d. Tremco Incorporated.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

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

    a. Bostik, Inc.
    b. Pecora Corporation.
    c. Tremco Incorporated.

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

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

    a. Pecora Corporation.
    b. Sherwin Williams Company (The).
    c. Tremco Incorporated.

2.7 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

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

    a. Adfast.
    b. Alcot Plastics Ltd.
    c. BASF Corporation.

d. Construction Foam Products.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) or as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 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 to joint substrates.

C. Masking Tape: Non-staining, 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 performance of the Work.

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, 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 after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include, however may not be limited to the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include, however may not be limited to the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by 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 or primer 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 in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind 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 bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that 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 in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs 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 sealant from surfaces adjacent to joints.
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 profile per Figure 8A in ASTM C1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealant 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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Joints between different materials listed above.

c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control joints in unit masonry.
b. Joints between different materials listed above.
c. Perimeter joints between materials listed above and frames of doors, windows and louvers.
d. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, non-staining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, P, 25, T.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Tile control and expansion joints.
c. Vertical joints on exposed surfaces of unit masonry, concrete, walls and partitions.
d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:
1. Section 083990 “Tornado-Resistant Steel Doors and Frames” for storm shelter doors and frames.
2. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
3. Section 099113 “Exterior Painting” for painting of exterior doors and frames.
4. Section 099123 “Interior Painting” for painting of interior frames.

1.3 REFERENCED STANDARDS

A. Steel Door Institute

B. Builders Hardware Manufacturers Association

1.4 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.5 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.

C. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.

D. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.

E. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.8 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of fire-rated hollow-metal door and frame and thermally rated door for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Field quality control reports.

1.9 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with 2 removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Ceco Door; ASSA ABLOY
2. Curries Company; ASSA ABLOY
3. Gensteel Doors, Inc.
4. Steelcraft; an Allegion brand

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated steel sheet, minimum thickness of 0.053-inch.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Manufacturer's standard.
g. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053-inch.
b. Construction: Full profile welded.

3. Exposed Finish: Primed.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053-inch, with minimum A40 coating.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Polyurethane.

C. Maximum-Duty Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule.

1. Frames:

    a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067-inch, with minimum A40 coating.
    b. Construction: Full profile welded.
    c. Exposed Finish: Prime.

2.5 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of 3 anchors per jamb, with 1 additional anchor for frames with no floor anchor. Provide 1 additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.8 FABRICATION

A. Door Astragals: Provide overlapping astragal on 1 leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4-inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in 1 piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive 3 door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive 2 door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Solidly pack mineral-fiber insulation inside frames.
4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus, or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Factory finishing flush wood doors.

B. Related Requirements:

1. Section 081113 “Hollow Metal Doors and Frames” for wood doors set inside hollow metal frames.
2. Section 087100 “Door Hardware” for hardware to be installed on doors.
3. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction.
3. Door face type and characteristics.
4. Door frame construction.
5. Factory-machining criteria.
6. Factory-finishing Specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door Schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Dimensions and locations of blocking for hardware attachment.
5. Dimensions and locations of mortises and holes for hardware.

6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Doors to be factory finished and application requirements.
9. Apply AWI Quality Certification Program label to Shop Drawings.
10. Samples for Initial Selection: For factory-finished doors.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors and frames that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4-inch in a 42- by 84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01-inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors and frames.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Doors: Complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252

B. Smoke- and Draft-Control Doors: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Provide labels and certificates from AWI certification program indicating that doors comply with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:

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

a. Eggers Industries
b. Lambton Doors.
c. Masonite Architectural.
d. Oshkosh Door Company.
e. VT Industries, Inc.

B. Performance Grade:

1. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated on Drawings.
2. Architectural Woodwork Standards Grade: Premium.
3. Faces: Single-ply wood veneer not less than 1/50-inch thick.

a. Species: Red oak.
b. Cut: Plain sliced (flat sliced).
c. Match between Veneer Leaves: Book match.
d. Assembly of Veneer Leaves on Door Faces: Balance match.
e. Pair and Set Match: Provide for doors hung in same opening.
f. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.

4. Exposed Vertical and Top Edges: Same species as faces - Applied wood-veneer edges of same species as faces and covering edges of faces - Architectural Woodwork Standards edge, Type B.

a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
b. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

5. Core for Non-Fire-Rated Doors: ANSI A208.1, Grade LD-2 particleboard.

   a. ANSI A208.1, Grade LD-2 particleboard.

      1) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087100 "Door Hardware."

   b. Glued wood stave.
   c. WDMA I.S. 10 structural composite lumber.

      1) Screw Withdrawal, Door Face: 550 lbf.
      2) Screw Withdrawal, Vertical Door Edge: 550 lbf.

   d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

6. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

   a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware and as follows:

      1) 5-inch top-rail blocking.
      2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
      3) 5-inch midrail blocking, in doors indicated to have armor plates.
      4) 5-inch midrail blocking, in doors indicated to have exit devices.

7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES

A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated on Drawings.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final Hardware Schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.6 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all 4 edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors that are indicated on Drawings to receive transparent finish.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Premium.
2. Finish: Architectural Woodwork Standards System-11, Polyurethane, Catalyzed.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed 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 Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors in accordance with NFPA 80.
2. Install smoke- and draft-control doors in accordance with NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that 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 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

SUMMARY

Section Includes: Access doors and frames for walls and ceilings.

ACTION SUBMITTALS

Product Data: For each type of product.

Include construction details, materials, individual components and profiles, and finishes.

Shop Drawings:

Include Plans, elevations, sections, details, and attachments to other work.
Detail fabrication and installation of access doors and frames for each type of substrate.

Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART - PRODUCTS

ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

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

Access Panel Solutions.
Babcock-Davis.
Metropolitan Door Industries Corp.

Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

Aluminum Flush Access Doors with Concealed Flanges:

Basis-of-Design Product: Access Panel Solutions; bauco-plus II.
Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
Locations: Ceiling.
Door Size: As indicated on Drawings.
Uncoated Steel Sheet for Door: Nominal 0.110-inch.

Finish: Factory prime.

Frame Material: Same material and thickness as door.
Hinges: Manufacturer's standard.
Hardware: Slotted cam latch.

Hardware:

Latch: Cam latch operated by screwdriver with interior release.

MATERIALS

Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness according to ANSI H35.2.

Frame Anchors: Same type as door face.

Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

FABRICATION

General: Provide access door and frame assemblies manufactured as integral units ready for installation.

Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.

Provide mounting holes in frames for attachment of units to metal or wood framing.

Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

FINISHES

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Aluminum Finishes: Finish door panel to match adjacent ceiling surface.

PART - EXECUTION

EXAMINATION

Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Proceed with installation only after unsatisfactory conditions have been corrected.

INSTALLATION

Comply with manufacturer's written instructions for installing access doors and frames.

Install doors flush with adjacent finish surfaces or recessed to receive finish material.

ADJUSTING

Adjust doors and hardware, after installation, for proper operation.

Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083990 - TORNADO-RESISTANT STEEL DOOR AND FRAME ASSEMBLIES

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. Tornado-resistant, fire-rated, pressed steel frames.
2. Tornado-resistant, fire-rated, steel swing doors.
3. Factory-supplied and installed hinges and latching devices.

B. Related Requirements:

1. Section 042200 “Concrete Unit Masonry” for mortar fill of metal frames.
2. Section 079200 “Joint Sealants” for caulking between doors and adjacent construction.
3. Section 087100 “Door Hardware” for hardware to be installed on doors.
4. Section 099123 “Interior Painting” for field painting of doors and frames.

1.3 REFERENCED STANDARDS

A. ASTM A36/A36M-14 - Standard Specification for Carbon Structural Steel.

B. ASTM A653/A653M-15el- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A1011/A1011M-17a Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

D. ICC 500-2014 - Standard for the Design and Construction of Storm Shelters

E. HMMA 802-07 - Manufacturing of Hollow Metal Doors and Frames.

F. HMMA 840-16 - Installation and Storage of Hollow Metal Doors and Frames.

G. NFPA 80-16 - Standard for Fire Doors and Other Opening Protectives.

H. UL10B - Standards for Fire Tests of Door Assemblies.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance:

1. Provide doors capable of withstanding a peak reflected pressure of 1.76 psi in accordance with tested ICC 500 standards.
2. Missile Impact Testing: 15-lb wood 2x4 traveling without pitch or yaw at 100 mph and striking perpendicular to the surface.
3. All items in assembly to conform to ICC 500 performance criteria.

1.5 REGULATORY REQUIREMENTS

A. Installed Door and Frame Assembly: Conform to NFPA 80 for fire-rated class as scheduled.

B. In conformance with ICC 500 (2014) standards.

1.6 ACTION SUBMITTALS

A. Product Data: Provide product data on door and frame construction.

B. Shop Drawings: Indicate door and frame elevations, internal reinforcement, anchor types, closure methods, factory finish and location of cut-outs for hardware.

C. Test Data: Submit independent test data from a recognized licensed laboratory indicating compliance with the tornado resistance requirements.

D. Closeout Submittals:

1. Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with and registered with manufacturer.

1.7 QUALITY ASSURANCE

A. Perform work to HMMA (Hollow Metal Manufacturers Association) standards.

B. Manufacturer: Minimum 5 years' documented experience manufacturing tornado-resistant door and frame assemblies.

C. Pre-installation Meeting: Coordinate a pre-installation meeting 2 weeks before start of installation of door and frame assemblies. Require attendance of parties directly affecting Work of this Section, including Contractor, installer, and manufacturer's representative. Notify Owner of pre-installation meeting for their consideration for attendance. Review installation and coordination with other work.

1.8 DELIVERY, STORAGE AND PROTECTION

A. Comply with HMMA 840.

B. Weld minimum 2 temporary jamb spreaders per frame prior to shipment.

C. Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.

D. Store in vertical position, spaced with blocking to permit air circulation between components.

E. Store materials out of water and covered to protect from damage.

F. Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.

1.9 WARRANTY

A. Manufacturer's Limited Warranty: Five years from date of supply, covering material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. AMBICO Limited.
2. Ceco (an ASSA ABLOY Group company).
3. DCI Hollow Metal.

B. Substitutions:

1. Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
2. Section 006325," Substitution Request."

2.2 PERFORMANCE REQUIREMENTS

A. Assemblies shall comply with test criteria established in ICC 500 (2014).

2.3 MATERIALS

A. Sheet Steel: Galvanized steel to ASTM A653/A653M.

1. Coating designation Z275 (G90) for shower room door assemblies.

B. Reinforcement Channel: To CSA G40.20/G40.21, coating designation to ASTM A653/A653M, ZF75 (A25).

1. Structural Plate: Hot rolled steel to ASTM A1011.

2.4 ACCESSORIES

A. Hinges: Heavy-weight, butt type shall be factory supplied loose.

B. Door Hardware: Multi-point mortise lock shall be factory supplied and pre-installed.

C. Primer: Rust inhibitive zinc phosphate.

2.5 FABRICATION

A. Manufacture doors and frames in accordance with ICC 500 tested assemblies.

B. Specify door thickness and other values with caution as they vary in order to meet fire standards. Openings that are fire rated up to 90 minutes, require doors 1-3/4-inch thick. Steel Doors.

C. Sheet steel faces, thickness, design, and core suitable to achieve specified tornado resistance.

D. Tornado-resistant construction, longitudinal edges welded, filled and sanded with no visible edge seams.

E. Top and Bottom Channels: Inverted, recessed, welded steel channels.

F. Weld structural steel channels flush to top and bottom of door.

G. Weld hardware reinforcement plates in place.

H. Steel Frames: Swing type.

I. Sheet steel and metal thickness appropriate to maintain tornado resistance.

J. Factory assemble and weld frames.

K. Multi-point latching devices to be factory supplied and pre-installed.

L. Affix permanent metal nameplates to door and frame, indicating manufacturer's name, door tag, model number, and performance rating.

2.6 PRE-INSTALLATION OF SWINGING DOOR HARDWARE

A. Hinges and multi-point latching device shall be supplied complete with tornado-resistant steel door and frame in conformance with tornado-resistant requirements of Project.

B. Hinges and latching device shall be factory pre-installed on the tornado-resistant steel door and frame assembly.

2.7 FINISHES

A. Factory Finish: Factory applied zinc phosphate primer shall be applied to all exposed surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install components including doors, frames, and hardware in accordance with manufacturer's written instructions.

B. Install doors and frames to HMMA 840 standards and in accordance with NFPA 80.

C. Coordinate with masonry wall construction for anchor placement.

D. Set frames plumb, square, level and at correct elevation.

E. Allow for deflection to ensure that structural loads are not transmitted to frame.

F. Adjust operable parts for correct clearances and function.

G. Finish paint in accordance with Section 09 91 00.

3.2 ERECTION TOLERANCES

A. Installation tolerances of installed frame for squareness, alignment, twist and plumbness are to be no more than ±1/16-inch in compliance with HMMA 841.

3.3 FIELD QUALITY CONTROL

A. Provide qualified manufacturer's representative to instruct installers on the proper installation and adjustment of door assemblies.

B. Provide manufacturer's representative to inspect door installation, and test minimum 10 cycles of operation. Correct any deficient doors.

END OF SECTION 083990

SECTION 084213 - ALUMINUM-FRAMED ENTRANCES

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: Aluminum-framed entrance door systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances, showing the following:

   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.
   e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Include point-to-point wiring diagrams.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and field testing agency.

B. Energy Performance Certificates: For aluminum-framed entrances, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance.

C. Product Test Reports: For aluminum-framed entrances.

D. Field quality-control reports.

E. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated and acceptable to Owner and Architect.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

1. Arcadia, Inc.
2. Avanti Systems, Inc.
3. EFCO Corporation.
4. Kawneer North America, an Arconic company.
5. Manko Window Systems, Inc.

B. Source Limitations: Obtain all components of aluminum-framed entrance, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

C. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, entrance doors do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, entrance doors, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

D. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas of entrance doors when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

E. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

   a. Entrance Doors: U-factor of not more than 0.77 Btu/sq. ft. x h x degrees F as determined according to NFRC 100.

2. Solar Heat-Gain Coefficient (SHGC):

   a. Entrance Doors: SHGC of not more than 0.40 as determined according to NFRC 200.

3. Air Leakage:

   a. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

4. Condensation Resistance Factor (CRF):

   a. Entrance Doors: CRF of not less than 63 as determined according to AAMA 1503.

F. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 4 for basic protection.

1. Small-Missile Test: For glazing located below 30 feet above grade.

G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

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

2.3 ALUMINUM-FRAMED ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Wide stile; 5-inch nominal width.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

4. Door Finish: Color anodic finish.

B. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125-inch thick and reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 4-1/2 inches.
2. Exterior Framing Construction: Thermally broken.
3. Finish: Match door finish.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
c. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
d. Structural Profiles: ASTM B308/B308M.

2. Steel Reinforcement:

a. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
b. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
c. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

3. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.4 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. General: Provide entrance door hardware for each entrance door, to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
2. Opening-Force Requirements:

a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

1. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

D. Continuous-Gear Hinges: BHMA A156.26.

E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

F. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.

G. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

H. Cylinders: As specified in Section 087100 "Door Hardware."

I. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

J. Operating Trim: BHMA A156.6.

K. Removable Mullions: BHMA A156.3 extruded aluminum.

1. When used with panic exit devices, provide keyed removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

L. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

M. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.

N. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

O. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.

P. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

Q. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2-inch.

2.5 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

E. Rigid PVC Filler.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018-mm or thicker.

1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.4 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on aluminum-framed entrances.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09-cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

C. Aluminum-framed entrances will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 MAINTENANCE SERVICE

A. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

3.7 ENTRANCE DOOR HARDWARE SETS

A. Doors E100A, E100B:

1. One each of Perimeter Weather Stripping.
2. One each of Bottom Door Sweep.
3. One each of Threshold.
4. One each of Continuous Hinge.

5. One each of Push/Pull.
6. One each of Rim Exit Device.
7. One each of Closer.

END OF SECTION 084213

SECTION 085113 - ALUMINUM WINDOWS

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 aluminum windows for exterior locations.

B. Related Requirements: Section 084213 "Aluminum-Framed Entrances" for coordinating finish among aluminum fenestration units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: For aluminum windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.
2. Exposed Hardware: Full-size units.

E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

C. Mockups: Reference Section 133419 “Metal Building Systems.”

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Failure to meet performance requirements.
   b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
   c. Faulty operation of movable sash and hardware.
   d. Deterioration of materials and finishes beyond normal weathering.
   e. Failure of insulating glass.

2. Warranty Period:

   a. Window: Ten years from date of Substantial Completion.
   b. Glazing Units: Ten years from date of Substantial Completion.
   c. Aluminum Finish: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AAMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: CW.
2. Minimum Performance Grade: 30.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.38 Btu/sq. ft. x h x deg F.

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40.

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 52.

F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

2.3 ALUMINUM WINDOWS

A. Basis-of-Design Product: Kawneer 8225TLF Thermal Window. Subject to compliance with requirements, other available manufacturers offering products that may be incorporated into the work include, but are not limited to the following:

1. EFCO Corporation.
2. Kawneer North America, an Arconic company.
3. Manko Window Systems, Inc.
4. Peerless Products Inc.

B. Types: Provide the following types in locations indicated on Drawings:

1. Fixed.

C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and

window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

D. Glass: Reference Section 088000 “Glazing.”

E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

F. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

B. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:

   a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
   b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to 1 decimal place.

3. Water-Resistance Testing:

   a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
   b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Mechanical door hardware for swinging doors.
2. Cylinders for door hardware specified in other Sections.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames."
2. Section 081416 "Flush Wood Doors."
3. Section 084213 "Aluminum-Framed Entrances."
4. Section 083990 "Tornado-Resistant Steel Door and Frame Assemblies."

1.3 COORDINATION

A. Floor-Recessed Door Hardware: Coordinate layout and installation with floor construction.

1. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.4 PREINSTALLATION MEETINGS

A. Keying Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner.
2. Incorporate conference decisions into Keying Schedule after reviewing door hardware keying system including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.

c. Address for delivery of keys.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For each type of exposed finish.

C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit Door Hardware Schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of Door Hardware Schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project Construction Schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in Door Hardware Schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set cross-referenced to Drawings on Floor Plans and to Door and Frame Schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Fastenings and other installation information.
e. Explanation of abbreviations, symbols, and designations contained in Door Hardware Schedule.
f. Mounting locations for door hardware.
g. List of related door devices specified in other Sections for each door and frame.

D. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For each type of door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final Door Hardware and Keying Schedule.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware: As required by the Owner.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of Door Hardware and Keying Schedule.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final Door Hardware Schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3-cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

C. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's "2010 ADA Standards for Accessible Design."

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2-inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.3 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and Door Hardware Schedule.

1. Door hardware is scheduled in Part 3.

2.4 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Hager.
2. Ives.
3. McKinney.

2.5 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Hager.
2. Ives.
3. McKinney.

2.6 THREE-POINT LOCK

A. Manufacturer and Product:

1. Sargent 7300.
2. Schlage LM9300.
3. Securitech 5000.

B. Requirements:

1. Provide 3-point locking system as part of integrated assembly including door, frame, and hardware.
2. **Tornado Applications:** Provide assembly UL approved to FEMA 361 and FEMA 320 guidelines for inswing and outswing single or pair doors. Must be used with tested and approved door and frame system. **NOTE: Must use hardware approved/tested with door supplied. Coordinate with Section 083990.**
3. Latchbolt Construction:
   a. Top Bolt: 5/8-inch stainless-steel square bolt with 3/4-inch projection. 1/2-inch-thick steel top plate. Stainless-steel sill strike and fasteners.
   b. Mortised Center Latchbolt; Stainless-steel latch. Fully wrapped, 12-gauge plated steel lock case. 2-3/4-inch backset. ANSI/BHMA curved lip strike 1-1/4 inches by 4-7/8 inches with dust box, non-handed.
   c. Bottom Bolt: 5/8-inch stainless-steel square bolt with 5/8-inch projection. Stainless-steel sill strike and fasteners.

2.7 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in Door Hardware Schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latch bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: 9K.
2. Levers: Cast.

   a. 15.

3. Escutcheons (Roses): Wrought.

   a. C.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latch bolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with 3-piece antifriction latch bolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.

1. Best.
2. Sargent.
3. Schlage.

2.8 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic Flush Bolts: BHMA A156.3, Type 25; minimum 3/4-inch throw; with dust-proof strikes; designed for mortising into door edge.

1. Hager.
2. Ives.
3. Rockwood.

2.9 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. Sargent.
2. Securitech.
3. Von Duprin.

B. **Tornado Applications:** Provide assembly UL approved to FEMA 361 and FEMA 320 guidelines for inswing and outswing single or pair doors. Must be used with tested and approved door and frame system. **NOTE: Must use hardware approved/tested with door supplied. Coordinate with Section 083990.**

2.10 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Best.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.

1. Core Type: Interchangeable.

C. High-Security Lock Cylinders: BHMA A156.30; Grade 1 permanent cores that are removable; face finished to match lockset.

1. Type: M, Mechanical.

D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.11 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix. Provide 1 extra key blank for each lock. Incorporate decisions made in keying conference.

1. No Master Key System: Only change keys operate cylinders.

a. Provide 3 cylinder change keys.

2. Master Key System: Change keys and a master key operate cylinders.

a. Provide 3 cylinder change keys and 5 master keys.

3. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.

a. Provide 3 cylinder change keys and 5 each of master and grand master keys.

4. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.

a. Provide 3 cylinder change keys and 5 each of master, grand master, and great-grand master keys.

5. Existing System (if Required):

a. Master key or grand master key locks to Owner's existing system.
b. Re-key Owner's existing master key system into new keying system.

6. Keyed Alike: Key all cylinders to same change key.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: Information to be furnished by Owner.

2.12 KEY CONTROL SYSTEM

A. Key Control Cabinet: As selected by the Owner: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. HPC.
2. Lund.
3. Telkey.

2.13 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.

1. Burns.
2. Ives.
3. Rockwood.

2.14 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Astragals: BHMA A156.22.

2.15 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Falcon.
2. LCN.
3. Norton.

2.16 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. Ives.
2. McKinney.
3. Rockwood.

2.17 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Glynn Johnson.
2. Rixson.
3. Rockwood.

2.18 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. National Guard Products.
2. Pemko.
3. Zero.

B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 0.3-inch wg, as follows:

1. Smoke-Rated Gasketing: 0.3-cfm/sq. ft. of door opening.
2. Gasketing on Single Doors: 0.3-cfm/sq. ft. of door opening.
3. Gasketing on Double Doors: 0.50-cfm per foot of door opening.

2.19 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. National Guard Products.
2. Pemko.
3. Zero.

2.20 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Ives.
2. McKinney.
3. Rockwood.

2.21 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames.
2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.
2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.22 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in Door Hardware Schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in Door Hardware Schedule, but not fewer than the number recommended by manufacturer for application indicated or 1 hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in Keying Schedule.
2. Furnish permanent cores to Owner for installation.

E. Key Control System:

1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final Keying Schedule.
2. Key Lock Boxes: By Owner to provide controlled access for fire and medical emergency personnel.

F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in Door Hardware Schedule. Do not mount floor stops where they will impede traffic.

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately 6 months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.8 DOOR HARDWARE SCHEDULE

Camp Crowder Training Site: 30-Man Barracks

Hardware Group 01
For use on Door #(s):
E100
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	99-L-06	626	VON
1	EA	CYLINDER	AS REQ'D	626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	MOUNTING PLATE	4040XP-18	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	WEATHER STRIPPING	BY DOOR AND FRAME MFG		
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	65A-226	A	ZER

Hardware Group 02
For use on Door #(s):
E104
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	STOREROOM LOCK	9K37D 15C	626	BES
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
2	EA	MEETING STILE	328AA-S	AA	ZER
2	EA	GASKETING	429AA-S	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	65A-226	A	ZER

Hardware Group 03
For use on Door #(s):
E101 E102
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	9K37D 15C	626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	65A-226	A	ZER

Hardware Group 04
For use on Door #(s):
103
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	9K37D 15C	626	BES
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

Hardware Group 05
For use on Door #(s):
105
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	9K37R 15C	626	BES
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

Hardware Group 06
For use on Door #(s):
101 102
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	9K37R 15C	626	BES
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

Hardware Group 07
For use on Door #(s):
105A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY SET	9K30L 15C	626	BES
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group 08
For use on Door #(s):
105B
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY SET	9K30L 15C	626	BES
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group 09
For use on Door #(s):
101A 102A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	MULT PT CLASSROOM	LM9370BD 06A	626	SCH
1	EA	CYLINDER	AS REQ'D	626	BES
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

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Hardware Group No. 10
For use on Door #(s):
104
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	MULT PT PASSAGE SET	LM9310 06A		626	SCH
1	EA	CYLINDER	AS REQ'D		626	BES
1	EA	SURFACE CLOSER	4040XP CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group 11
For use on Door #(s):
101B 102B
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	EXIT LOCK	9K30Y 15C		626	BES
1	EA	SURFACE CLOSER	4040XP EDA SRI		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	GASKETING	488SBK PSA		BK	ZER

END OF SECTION 087100

SECTION 088000 - GLAZING

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. Glass for windows, doors and storefront framing.
2. Glazing sealants and accessories.

B. Related Requirements: Section 102800 “Toilet, Bath and Laundry Accessories” for mirrors.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

1. Laminated glass.
2. Insulating glass.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For glass.

C. Product Test Reports: For coated glass, insulating glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.9 DELIVERY, STORAGE, AND HANDLING

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

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD 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 glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees F.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: Ten years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to 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.

1. Warranty Period: Ten years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to 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. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. AGC Glass Company North America, Inc.
2. Cardinal Glass Industries.
3. Guardian Glass; SunGuard.
4. Oldcastle BuildingEnvelope™.
5. Pilkington North America.
6. Trulite Glass & Aluminum Solutions, LLC.
7. Viracon, Inc.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Windborne-Debris Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 4 for basic protection.

1. Large-Missile Test: For glazing located within 30 feet of grade.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.

2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least 1 component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than 0.030-inch and as needed to comply with the requirements.
3. Interlayer Color: Clear unless otherwise indicated.

B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with 1 of the following to comply with interlayer manufacturer's written instructions:

1. Polyvinyl butyral interlayer.
2. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
3. Interlayer Thickness: Provide thickness determined from ASTM E1300-09a but not less than 0.030-inch thick.
4. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they 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.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; 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; and complying with ASTM C1281 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.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with 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: Type recommended by sealant or glass manufacturer.

D. Spacers: Type recommended by sealant or glass manufacturer.

E. Edge Blocks: Type recommended by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Glazing Frame Bite: In accordance with ASTM F2248.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit 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 publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, 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 systems.
3. Minimum required face and 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.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage

or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. 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.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

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.

G. 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.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into 1 side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

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 1 continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, 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 right 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 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket 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. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than 4 days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 INSULATING-LAMINATED-GLASS SCHEDULE

A. Glass Type GL-1: Low-E-coated, clear insulating laminated glass.

1. Overall Unit Thickness: 1 inch.
2. Minimum Thickness of Outdoor Lite: 1/4-inch.
3. Outdoor Lite: Heat-strengthened float glass.
4. Interspace Content: Air or argon as needed to achieve performance requirements.
5. Indoor Lite: Clear laminated glass with 2 plies of heat-strengthened float glass.

    a. Minimum Thickness of Each Glass Ply: 1/8-inch.
    b. Interlayer Thickness: 0.030-inch minimum.

6. Low-E Coating: Pyrolytic or sputtered on second or third surface.
7. Winter Nighttime U-Factor: 0.27 maximum.
8. Summer Daytime U-Factor: 0.27 maximum.
9. Visible Light Transmittance: 65 percent minimum.
10. Solar Heat Gain Coefficient: 0.40 maximum.

B. Glass Type GL-2: Low-E-coated, clear insulating laminated safety glass.

1. Overall Unit Thickness: 1 inch.
2. Minimum Thickness of Outdoor Lite: 1/4-inch.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Air or argon as needed to achieve performance requirements.

5. Indoor Lite: Clear laminated glass with 2 plies of fully tempered float glass.

    a. Minimum Thickness of Each Glass Ply: 1/8-inch.
    b. Interlayer Thickness: 0.030-inch minimum.

6. Low-E Coating: Pyrolytic or sputtered on second or third surface.
7. Winter Nighttime U-Factor: 0.27 maximum.
8. Summer Daytime U-Factor: 0.27 maximum.
9. Visible Light Transmittance: 65 percent minimum.
10. Solar Heat Gain Coefficient: 0.40 maximum.
11. Safety glazing required.

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL 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. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements: Section 092900 "Gypsum Board."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
2. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.

1. Steel Studs and Tracks:

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

1) ClarkDietrich.
2) MarinoWARE.
3) MBA Building Supplies.
4) MRI Steel Framing, LLC.
5) Steel Construction Systems.

b. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
c. Depth: As indicated on Drawings.

2. Embossed, High-Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.

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

1) ClarkDietrich.
2) MarinoWARE.
3) MBA Building Supplies.
4) MRI Steel Framing, LLC.
5) Steel Construction Systems.

b. Minimum Base-Steel Thickness: As required by horizontal deflection performance requirements.
c. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide 1 of the following:

1. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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

1) ClarkDietrich.
2) MarinoWARE.
3) MBA Building Supplies.
4) Steel Construction Systems.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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

a. ClarkDietrich.
b. MarinoWARE.
c. Steel Construction Systems.

E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.

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

    a. ClarkDietrich.
    b. MarinoWARE.
    c. MBA Building Supplies.
    d. MRI Steel Framing, LLC.

2. Steel Construction Systems Depth: 1-1/2 inches.
3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C645.

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

    a. ClarkDietrich.
    b. MarinoWARE.
    c. MBA Building Supplies.
    d. MRI Steel Framing, LLC.
    e. Steel Construction Systems.

2. Minimum Base-Steel Thickness: 0.0296-inch.
3. Depth: As indicated on Drawings.

G. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: 3/4-inch.
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329-inch.
3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16-inch in diameter.

C. Flat Hangers: Steel sheet, 1 by 3/16-inch by length indicated.

D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538-inch and minimum 1/2-inch-wide flanges.

1. Depth: 1-1/2 inches.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4-inch deep.

2. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8-inch deep.

a. Minimum Base-Steel Thickness: 0.0296-inch.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

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.

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 of the Work.

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work 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 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
2. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

   a. Install 2 studs at each jamb unless otherwise indicated.
   b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

3. Other Framed Openings: 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.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches on center.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8-inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches on center.
2. Carrying Channels (Main Runners): 48 inches on center.
3. Furring Channels (Furring Members): 24 inches on center.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend 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 suspension system.

    a. 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 locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Installation Tolerances: Install suspension systems that are level to within 1/8-inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

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. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements: Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

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

   a. American Gypsum.
   b. CertainTeed Gypsum.
   c. Georgia-Pacific Gypsum LLC.
   d. National Gypsum Company.
   e. USG Corporation.

2. Thickness: 1/2-inch.
3. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

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

   a. American Gypsum.
   b. CertainTeed Gypsum.
   c. Georgia-Pacific Gypsum LLC.
   d. National Gypsum Company.
   e. USG Corporation.

2. Thickness: 5/8-inch.
3. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396/C1396M.

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

   a. American Gypsum.
   b. CertainTeed Gypsum.
   c. Georgia-Pacific Gypsum LLC.
   d. National Gypsum Company.
   e. USG Corporation.

2. Thickness: 1/2-inch.
3. Long Edges: Tapered.

D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

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

   a. American Gypsum.
   b. CertainTeed Gypsum.
   c. Georgia-Pacific Gypsum LLC.
   d. National Gypsum Company.
   e. USG Corporation.

2. Core: 5/8-inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

E. Water-Resistant Gypsum Backing Board: ASTM C1396/C1396M, with manufacturer's standard edges.

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

    a. American Gypsum.
    b. CertainTeed Gypsum.
    c. Georgia-Pacific Gypsum LLC.
    d. National Gypsum Company.
    e. USG Corporation.

2. Core: 5/8-inch, Type X.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. L-Bead: L-shaped; exposed long flange receives joint compound.
    c. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    d. Control joint.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints 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 drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Mold-Resistant Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats and for mold-resistant gypsum board.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033- to 0.112-inch thick.

C. Sound-Attenuation Blankets: ASTM C665, 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.

D. Acoustical Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

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

a. Grabber Construction Products.
b. Hilti, Inc.
c. Pecora Corporation.
d. Specified Technologies, Inc.
e. USG Corporation.

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than 1 framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16-inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 square feet in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on 1 side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: Where required for fire-resistance-rated assembly.
3. Ceiling Type: As indicated on Drawings.
4. Mold-Resistant Type: As indicated on Drawings and any type of room where above normal humidity or moisture is expected.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels 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 1 framing member in alternate courses of panels.
    b. At high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.5 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 as indicated on Drawings, according to ASTM.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. L-Bead: Use where indicated.

3. U-Bead: Use at exposed panel edges and/or where indicated.

3.6 FINISHING GYPSUM BOARD

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 and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

   a. Exception: Fire-rated assemblies not exposed to view shall meet the requirements for construction of a rated assembly.

2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

   a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS (APC1)

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

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. United States Gypsum Company.

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide panels as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular.
2. Pattern: As indicated by manufacturer's designation.

D. Color: White.

E. Light Reflectance (LR): Not less than 0.90.

F. Ceiling Attenuation Class (CAC): Not less than 35.

G. Noise Reduction Coefficient (NRC): Not less than 0.70.

H. Edge/Joint Detail: Square.

I. Thickness: 3/4-inch.

J. Modular Size: As indicated on Drawings.

K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

L. Sag and Humidity Resistance: Manufacturer’s standard formulation allowing ceiling panels to maintain humidity and sag resistance.

2.4 METAL SUSPENSION SYSTEM (APC1)

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

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.

3. Chicago Metallic Company.
4. United States Gypsum Company.

B. Metal Suspension System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.

C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted white.

2.5 ACCESSORIES

A. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at 3 times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.

C. Hold-Down Clips: Manufacturer's standard hold-down.

D. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this

and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on Reflected Ceiling Plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M, seismic design requirements, manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
3. Do not attach hangers to steel roof deck. Attach hangers to structural members.
4. Space hangers not more than 48 inches on center along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
5. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches on center and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Install panels with pattern running in 1 direction parallel to short axis of space.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Install hold-down and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

a. Hold-Down Clips: Space 24 inches on center on all cross runners.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross-runners level to a tolerance of 1/8-inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8-inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

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: Thermoset-rubber base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET RUBBER BASE RB1

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

1. Flexco.
2. Johnsonite; a Tarkett company.
3. Roppe Corporation, USA.

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location: Style B, Cove.

C. Thickness: 0.125-inch.

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors: As indicated on Drawings.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

   a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

   a. Miter or cope corners to minimize open joints.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096723 - RESINOUS FLOORING

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: Resinous flooring systems

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated. Installer shall have a minimum of 7 years' experience installing seamless resinous floors similar in size and function of this Project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

1.9 WARRANTY

A. Surfacing applicator must provide a written guarantee for materials ad workmanship between applicator and surfacing manufacturer for 1 year.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Flammability: Self-extinguishing according to ASTM D635.

2.2 MANUFACTURERS

A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

2.3 RESINOUS FLOORING

A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.

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

a. Desco Coatings, Inc.
b. Key Resin Company.
c. Tnemec Company, Inc.

B. System Characteristics:

1. Color and Pattern: As indicated in Drawings.
2. Wearing Surface: Orange-peel texture.
3. Overall System Thickness: 3/16-inch.
4. UV Resistance: Manufacturer's recommended UV-resistant finish for light color combinations.

C. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.

1. Formulation Description: 100 percent solids epoxy.

D. Reinforcing Membrane: Flexible resin formulation that is recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.

1. Formulation Description: 100 percent solids.

E. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

F. Body Coats:

1. Resin: Epoxy.
2. Formulation Description: 100 percent solids.
3. Type: Clear.
4. Application Method: Troweled or screeded.
5. Number of Coats: One.
6. Thickness of Coats: 1/8-inch.
7. Aggregates: Colored quartz (ceramic-coated silica).

G. Grout Coat:

1. Resin: Epoxy.
2. Formulation Description: 100 percent solids.
3. Type: Clear.
4. Number of Coats: Three.
5. Thickness of Coat: 10 mils.

H. Topcoats: Sealing or finish coats.

1. Resin: Urethane.
2. Formulation Description: 100 percent solids.
3. Type: Clear.
4. Number of Coats: Two.
5. Thickness of Coats: 5 mils.
6. Finish: Matte.

I. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Compressive Strength: 10,000 psi minimum according to ASTM C579.
2. Tensile Strength: 2,250 psi minimum according to ASTM C307.
3. Flexural Modulus of Elasticity: 4,000 psi minimum according to ASTM C580.
4. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation according to MIL-D-3134J.
5. Resistance to Elevated Temperature: No slip or flow of more than 1/16-inch according to MIL-D-3134J.
6. Abrasion Resistance: 0.08 gm maximum weight loss according to ASTM D4060.
7. Hardness: 85-90, Shore D according to ASTM D2240.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Comply with NACE No. 6/SSPC-SP13, with a Concrete Surface Profile (CSP) of 3 or greater in accordance with the International Concrete Repair Institute (ICRI) Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lbs. of water/1,000 sq. ft. of slab area in 24 hours.
b. Relative Humidity Test: Use in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement.

4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.2 INSTALLATION

A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Reinforcing Membrane: Apply reinforcing membrane to substrate cracks.

D. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: As indicated on Drawings.

E. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended by manufacturer.

F. Grout Coat: Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat.

G. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated. The second topcoats shall be applied 24 hours after the first topcoat was applied.

3.3 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

SECTION 099113 - EXTERIOR PAINTING

PART - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

SUMMARY

Section includes surface preparation and the application of paint systems on the following exterior substrates:

Steel.
Galvanized metal.

Related Requirements:

Section 099600 "High-Performance Coatings" for special-use coatings.
Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
3. Section 133419 “Metal Building Systems” for shop priming of metal substrates with primers specified in this Section.

DEFINITIONS

Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

ACTION SUBMITTALS

Product Data: For each type of product. Include preparation requirements and application instructions.

Samples for Initial Selection: For each type of topcoat product.

Samples for Verification: For each type of paint system and each color and gloss of topcoat.

Submit Samples on rigid backing, 8 inches square.
Step coats on Samples to show each coat required for system.
Label each coat of each Sample.
Label each Sample for location and application area.

Product List: For each product indicated, include the following:

Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
VOC content.

MAINTENANCE MATERIAL SUBMITTALS

Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Paint: 2 percent, but not less than 1 gallon of each material and color applied.

DELIVERY, STORAGE, AND HANDLING

Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.

Maintain containers in clean condition, free of foreign materials and residue.
Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.

Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

PART - PRODUCTS

MANUFACTURERS

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

Benjamin Moore & Co.
PPG Architectural Finishes, Inc.
Sherwin-Williams Company (The).

PAINT, GENERAL

MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

Material Compatibility:

Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

Colors: As selected by Architect from manufacturer's full range.

METAL PRIMERS

Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.

Primer, Alkyd, Quick Dry, for Metal: MPI #76.

Primer, Galvanized, Water Based: MPI #134.

Primer, Galvanized: As recommended in writing by topcoat manufacturer.

Primer, Quick Dry, for Aluminum: MPI #95.

WATER-BASED PAINTS

Latex, Exterior Low Sheen (Gloss Level 3-4): MPI #15.

Latex, Exterior Semigloss (Gloss Level 5): MPI #11.

SOLVENT-BASED PAINTS

Alkyd, Exterior, Semigloss (Gloss Level 5): MPI #94.

Alkyd, Quick Dry, Semigloss (Gloss Level 5): MPI #81.

PART - EXECUTION

EXAMINATION

Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

Proceed with coating application only after unsatisfactory conditions have been corrected.

Application of coating indicates acceptance of surfaces and conditions.

PREPARATION

Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

SSPC-SP 2, "Hand Tool Cleaning."
SSPC-SP 3, "Power Tool Cleaning."

SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

APPLICATION

Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

Use applicators and techniques suited for paint and substrate indicated.
Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

Paint the Following Work Where Exposed to View:

Equipment, including panelboards and switch gear.
Uninsulated metal piping.
Uninsulated plastic piping.
Pipe hangers and supports.
Metal conduit.
Plastic conduit.

Tanks that do not have factory-applied final finishes.

FIELD QUALITY CONTROL

Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

Contractor shall touch up and restore painted surfaces damaged by testing.
If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

CLEANING AND PROTECTION

At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

EXTERIOR PAINTING SCHEDULE

Steel Substrates:

Water-Based Alkyd Urethane System:

Prime Coat: Primer, rust-inhibitive, water-based, MPI #107.
Prime Coat: Shop primer specified in Section where substrate is specified.
Intermediate Coat: Water-based acrylic-alkyd, exterior, matching topcoat.
Topcoat: Water-based alkyd-urethane, exterior, semigloss (Gloss Level 5), MPI #169.

Galvanized-Metal Substrates:

Water-Based Alkyd Urethane System:

Prime Coat: Primer, rust-inhibitive, water-based, MPI #107.

Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
Intermediate Coat: Water-based acrylic-alkyd, exterior, matching topcoat.
Topcoat: Water-based alkyd-urethane, exterior, semigloss (Gloss Level 5), MPI #169.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on interior substrates.

1. Concrete masonry units (CMUs).
2. Steel and iron.
3. Gypsum board.
4. Spray-textured ceilings.

B. Related Requirements: Section 099600 "High-Performance Coatings" for tile-like coatings.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gallon of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Benjamin Moore & Co.

2. PPG Paints.
3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Masonry (Clay and CMUs): 12 percent.
2. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.

d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Latex System:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52.

2. Water-Based Light Industrial Coating System:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
b. Intermediate Coat: Light industrial coating, interior, water-based, matching topcoat.
c. Topcoat: Light industrial coating, interior, water-based (MPI Gloss Level 3), MPI #151.

B. Steel Substrates:

1. Water-Based/Alkyd Urethane System:

a. Prime Coat: Primer, rust-inhibitive, water-based, MPI #107.
b. Intermediate Coat: Water-based acrylic-alkyd, exterior, matching topcoat.
c. Topcoat: Water-based alkyd-urethane, exterior, semi-gloss (MPI Gloss Level 5), MPI #169.

C. Spray-Textured Ceiling Substrates:

1. Water-Based Dry-Fall System: Exposed ceilings.

a. Topcoat: Dry-fall, latex (MPI Gloss Level 3), MPI #155.

D. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

2. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer sealer, latex, interior, MPI #149.
b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.

c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), MPI #151, epoxy enamel.

END OF SECTION 099123

SECTION 099600 - HIGH-PERFORMANCE COATINGS

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 surface preparation and the application of high-performance coating systems on the following substrates:

1. Interior Substrates: Gypsum board.
2. Interior Substrates: Concrete masonry units (CMUs).

B. Related Requirements:

1. Section 099113 "Exterior Painting" for general field painting.
2. Section 099123 "Interior Painting" for general field painting.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 degrees F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Desco Coatings, Inc.
2. Key Resin Company.
3. Sherwin-Williams Company (The).
4. Tnemec Inc.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

B. Overall System Thickness: The total film thickness for the coating system shall be a 10-15 mil system sans reinforcing.

C. Colors: As indicated in Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

B. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

C. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceed that permitted in manufacturer's written instructions.

1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi or 1,500 to 4,000 psi at 6 to 12 inches.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Gypsum Board Substrates:

1. Wall Coatings Epoxy System:

a. Body Coat: Epoxy
b. Topcoat: Urethane.
c. Topcoat: Urethane.

B. CMU Substrates:

1. Wall Coatings Epoxy System:

a. Block Filler: Block filler, epoxy.
b. Body Coat: Epoxy.
c. Topcoat: Urethane, gloss.
d. Topcoat: Urethane, gloss.

END OF SECTION 099600

SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

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 room-identification signs that are directly attached to the building.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design."

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign <RN, RR, SS>: Signs with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirments, available manufaturers offering poducts that may be incorporated into the Work include, but are limited to the following:

   a. ASI Sign Systems, Inc.
   b. Inpro Corporation
   c. 2/90 Sign Systems

2. Laminated-Sheet Sign (Interior Signs): Photopolymer face sheet with raised graphics laminated to acrylic or phenolic backing sheet to produce composite sheet.

   a. Composite-Sheet Thickness: 0.25-inch.
   b. Surface-Applied Graphics: Applied vinyl film or paint.
   c. Subsurface Graphics: Reverse halftone or dot-screen image or reverse etch image.
   d. Color(s): As selected by Architect from manufacturer's full range.

3. Solid-Sheet Sign (Exterior Signs): Aluminum, Bronze, or Stainless-steel sheet with finish specified in "Surface Finish and Applied Graphics" subparagraph and as follows:

   a. Thickness: 0.25-inch.
   b. Surface-Applied, Flat Graphics: Applied baked enamel or powder coat.
   c. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.
   d. Etched and Filled Graphics: Sign face etched or routed to receive enamel-paint infill.

4. Sign-Panel Perimeter: Finish edges smooth.

   a. Edge Condition: Square cut.
   b. Corner Condition in Elevation: As indicated on Drawings; rounded to radius indicated.

5. Mounting: Surface-mounted to wall with concealed anchors.
6. Text and Typeface: Accessible raised characters and Braille and typeface as indicated on Drawings. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Bronze Plate: ASTM B36/B36M, lead-free alloy recommended by manufacturer and finisher for finish indicated.

D. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316, stretcher-leveled standard of flatness.

E. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

F. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

G. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV- and water-resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish nonferrous-metal, stainless-steel, or hot-dip galvanized devices unless otherwise indicated.
3. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.8 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
2. Directional Satin Finish: No. 4.
3. Dull Satin Finish: No. 6.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423.16

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

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: Phenolic-core toilet compartments configured as toilet enclosures.

B. Related Requirements: Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of centerlines of toilet fixtures.
3. Show locations of floor drains.
4. Show overhead support or bracing locations.

C. Samples for Initial Selection: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: One hinge with associated fasteners.

2. Latch and Keeper: One latch and keeper with associated fasteners.
3. Door Bumper: One door bumper with associated fasteners.
4. Door Pull: One door pull with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARMENTS

A. Manufacturers: Subject to compliance with requirments, available manufacturers offering poducts that may be incorporated into the Work include, but are not limited to the following:

1. Accurate Partitons Corporation; An ASI Group Company.
2. Bobrick Washroom Equipment, Inc.
3. Bradley Corporation.
4. Panolam Industries International, Inc.

B. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch-thick doors and pilasters and minimum 1/2-inch-thick panels.

C. Pilaster Shoes, Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

D. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

E. Phenolic-Panel Finish:

1. Facing Sheet Finish: One color and pattern in each room.
2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.
3. Edge Color: Through-color matching facing sheet color.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's minimum 0.062-inch-thick stainless-steel continuous, spring-loaded type, allowing emergency access by lifting door. Mount with through-bolts.
2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
5. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with anti-grip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Extrusions: ASTM B 221.

B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

C. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2-inch.
b. Panels and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than 2 fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.17

SECTION 102600 - WALL AND DOOR PROTECTION

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: Corner guards.

B. Related Requirements: Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two 48-inch-long units.

2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 degrees F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 degrees F.

a. Store corner-guard covers in a vertical position.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

2.3 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards (CG1): Fabricated as 1 piece from formed or extruded metal with formed edges; with 90-degree turn to match wall condition.

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

   a. Construction Specialties, Inc.
   b. Inpro Corporation.
   c. Korogard Wall Protection Systems; a division of RJF International Corporation.

2. Material: Stainless-steel sheet, Type 430.

   a. Thickness: Minimum 16 gauge.
   b. Finish: Manufacturer’s standard finish.

3. Corner Radius: 1/8-inch.
4. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes or oval head, countersunk screws through factory-drilled mounting holes per manufacturer’s instructions. All screws should be the same.

2.4 MATERIALS

A. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.5 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings. If not indicated on Drawings, install at heights indicated below:

1. Corner Guards shall be installed directly above wall base.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

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. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Underlavatory guards.
4. Custodial accessories.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for 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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: Fifteen years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Toilet Tissue (Roll) Dispenser TTD:

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

a. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
3. Mounting: Surface mounted.
4. Operation: Non-control delivery with standard spindle.
5. Capacity: Designed for 4-1/2- or 5-inch-diameter tissue rolls.
6. Material and Finish: Stainless steel, ASTM A480 No. 4 finish (satin).

C. Paper Towel (Folded) Dispenser PTD:

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

a. American Specialties, Inc.

b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Mounting: Surface mounted.
3. Minimum Capacity: 400 C-fold or 525 multifold towels.
4. Material and Finish: Stainless steel, ASTM A480 No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicator: Pierced slots at sides or front.
7. Depth: Maximum 4 inches per ADAAG.

D. Combination Towel (Folded) Dispenser/Waste Receptacle PTDWR:

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

a. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
3. Mounting: Semi-recessed.

a. Designed for nominal 4-inch wall depth.

4. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
5. Minimum Waste-Receptacle Capacity: 12 gallons.
6. Material and Finish: Stainless steel, ASTM A480 No. 4 finish (satin).
7. Liner: Reusable, vinyl waste-receptacle liner.
8. Lockset: Tumbler type for towel-dispenser compartment.

E. Liquid-Soap Dispenser SD:

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

a. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 40 ounces.
5. Materials: ABS plastic valve and stainless-steel reservoir, satin finish.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

F. Grab Bar GB1, GB2, GB3, GB4:

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

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05-inch thick.

   a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

G. Mirror Unit MG:

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

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Frame: Stainless-steel channel.

   a. Corners: Welded and ground smooth.

3. Integral Shelf: 5 inches deep.
4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

   a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
   b. Wall bracket of galvanized steel equipped with concealed locking devices requiring a special tool to remove.

5. Size: As indicated on Drawings.

H. Coat Hook:

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

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
4. Provide 1 coat hook per toilet fixture.

2.2 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.

B. Shower Curtain Rod SCR1, SCR2:

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

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: 1-inch OD; fabricated from nominal 0.0375-inch-thick stainless steel.
3. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
4. Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Shower Curtain SC1, SC2: By others.

D. Folding Shower Seat FSS:

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

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or 1-piece construction in color as selected by Architect.

4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Dimensions: refer to drawings for size.

E. Soap Dish SH:

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

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: Without washcloth bar.
3. Mounting: Surface mounted.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

F. Robe Hook RH:

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

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.3 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

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

   a. Buckaroos, Inc.
   b. Plumberex Specialty Products, Inc.
   c. Truebro by IPS Corporation.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.
4. Provide at all lavatory fixtures.

2.4 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Mop and Broom Holder MH:

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

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: Unit with shelf, hooks and holders suspended beneath shelf.
3. Length: 36 inches.
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

   a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.

2.5 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

C. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of 6 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. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

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: Fire-protection cabinets for portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semi-recessed mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Samples for Initial Selection: For each type of exposed finish required.

E. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

F. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semi-recessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

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

a. Babcock-Davis.
b. JL Industries, Inc.; a Division of the Activar Construction Products Group.
c. Larsen’s Manufacturing Company.

B. Cabinet Construction: Non-rated.

C. Cabinet Material: Cold-rolled steel sheet.

D. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Steel sheet.

F. Door Material: Steel sheet.

G. Door Style: Fully glazed panel with frame.

H. Door Glazing: Break glass.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard.

2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
3. Door Lock: Cylinder lock, keyed alike to other cabinets.
4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated:

   a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

      1) Location: Applied to cabinet glazing.
      2) Application Process: Decals or pressure-sensitive vinyl letters.
      3) Lettering Color: White.
      4) Orientation: Vertical.

K. Materials:

1. Cold-Rolled Steel: ASTM A1008, Commercial Steel (CS), Type B.

   a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
   b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   c. Color: As selected by Architect from manufacturer's full range.

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.
4. Prepare doors and frames to receive locks.
5. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2-inch thick.
2. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in 1 piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated on the Drawings.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide semi-recessed fire-protection cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements: Section 104413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
    b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

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

    a. Babcock-Davis.
    b. JL Industries, Inc.; a Division of the Activar Construction Products Group.
    c. Larsen’s Manufacturing Company.

2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories from single source from single manufacturer.
3. Valves: Manufacturer's standard.
4. Handles and Levers: Manufacturer's standard.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb. nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

C. Purple-K dry-chemical type in stainless-steel cylinder with protective nozzle tip orifice seal and nonmetallic nozzle tip finger guard, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin, and upright squeeze grip: UL-rated 2.5 liters nominal capacity, with potassium bicarbonate-based dry chemical in enameled-stainless-steel container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

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

a. Babcock-Davis.
b. JL Industries, Inc.; a Division of the Activar Construction Products Group.
c. Larsen’s Manufacturing Company.

2. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: Locate top of fire extinguisher not to exceed 48 inches to the handle above finished floor.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 122413 - ROLLER WINDOW SHADES

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: Manually operated roller shades with single rollers.

B. Related Requirements: Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than 2 units.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

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

1. Draper Inc.
2. Hunter Douglas Contract.
3. MechoShade Systems, Inc.
4. Springs Window Fashions; SWFcontract.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.

    a. Loop Length: Full length of roller shade.
    b. Limit Stops: Provide upper and lower ball stops.
    c. Chain-Retainer Type: Chain tensioner, jamb mounted.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

    a. Provide for shadebands that weigh more than 10 pounds or for shades as recommended by manufacturer, whichever criterion is more stringent.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

    a. Shape: L-shaped.
    b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches.

2. Endcap Covers: To cover exposed endcaps.

3. Installation Accessories Color and Finish: As selected from manufacturer’s full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: PVC-coated polyester.
3. Weave: Basketweave.
4. Roll Width: 48 inches.
5. Orientation on Shadeband: Up the bolt.
6. Openness Factor: As indicated on Drawings.
7. Color: As indicated on Drawings.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 degrees F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4-inch per side or 1/2-inch total, plus or minus 1/8-inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4-inch, plus or minus 1/8-inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

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

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Roller Shade Locations: At exterior windows as indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

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. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.
5. Solid surface material sinks.

B. Related Requirements: Section 221100 “Domestic Water Pipe and Fittings” and Section 221300 "Sanitary Pipe and Fittings" for plumbing fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of countertops.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

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

a. Avonite Surfaces.
b. E. I. du Pont de Nemours and Company.
c. Formica Corporation.
d. Wilsonart LLC.

2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
4. Colors and Patterns: As indicated in Drawings.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Countertops: 1/2-inch-thick, solid surface material with front edge built up with same material.

C. Backsplashes: 1/2-inch-thick, solid surface material.

D. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

E. Joints: Fabricate countertops without joints.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16-inch into fixture opening.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8-inch in 8 feet, 1/4-inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

C. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

D. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

E. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 133419 - METAL BUILDING SYSTEMS

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. Structural-steel framing.
2. Metal roof panels.
3. Metal wall panels.
4. Metal soffit panels.
5. Thermal insulation (exterior walls and roof).
6. Accessories.

B. Related Requirements:

1. Section 077253 “Snow Guards” for prefabricated devices designed to hold snow on the roof surface.
2. Section 081113 “Hollow Metal Doors and Frames.”
3. Section 084213 “Aluminum-Framed Entrances.”
4. Section 085113 “Aluminum Windows.”

1.3 SUBSTITUTIONS

A. Any substitution of a roof system other than those specified must be approved at least 10 days in advance of Bid Date using the appropriate Substitution Request form.

1.4 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to metal building systems including, but not limited to, the following:

   a. Condition of foundations and other preparatory work performed by other trades.
   b. Structural load limitations.
   c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
   d. Required tests, inspections, and certifications.
   e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.

2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

   a. Meet with Owner, Architect, Owner’s insurer if applicable, metal panel installer, metal roof system panel manufacturer’s representative, structural support installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
   b. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
   c. Structural limitations of purlins and rafters during and after roofing.
   d. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
   e. Temporary protection requirements for metal roof panel assembly during and after installation.
   f. Roof observation and repair after metal roof panel installation.
   g. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

   a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
   b. Structural limitations of girts and columns during and after wall panel installation.
   c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
   d. Temporary protection requirements for metal wall panel assembly during and after installation.
   e. Wall observation and repair after metal wall panel installation.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Metal roof panels.
b. Metal wall panels.
c. Metal soffit panels.
d. Thermal insulation and vapor-retarder facings.

B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:

1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
2. Structural Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross sections.

a. Show provisions for attaching roof curbs and other items attached to building as indicated in the Drawings.

3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details including bracing. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

a. Show location of roof-mounted items including equipment supports, pipe supports and penetrations, lighting fixtures, braced walls, and items mounted on roof curbs.
b. Show location of wall-mounted items including personnel doors, windows, louvers, and lighting fixtures.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 3 inches per 12 inches:

a. Flashing and trim.
b. Gutters.
c. Downspouts.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Samples for Verification: For the following products:

1. Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.

2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
3. Vapor-Retarder Facings: Nominal 6-inch-square Samples.
4. Accessories: Nominal 12-inch-long Samples for each type of accessory.

E. Delegated-Design Submittal: For metal building systems.

1. Include shop drawings and analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Systems Letter: From roof system manufacturer agreeing that "All roofing components, exclusive of the deck, contained in the system proposed are approved and compatible with the warranty requirements of the roof system as specified, and that the warranty specified will be issued at completion of the Project if system is installed as designed."

G. End of Day Procedure: Provide a detail showing proposed "night seal" or "cut-off flashing" to be used at the end of each day's work.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For erector and manufacturer.

B. Welding certificates.

C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

1. Name and location of Project.
2. Order number.
3. Name of manufacturer.
4. Name of Contractor.
5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
7. Governing building code and year of edition.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

D. Erector Certificates: For qualified erector, from manufacturer.

E. Material Test Reports: For each of the following products:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranties: For all warranties.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes to include in maintenance manuals.

1.10 QUALITY ASSURANCE

A. Codes and Standards:

1. AISC “Code of Standard Practice for Steel Buildings and Bridges.”
2. AISC “Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.”
3. AISC “Specifications for Structural Joints using ASTM A325 or A490 Bolts.”
4. AWS D1.1 “Structural Welding Code.”
5. ICC – International Code Council
6. Metal Building Manufacturer’s Association (MBMA) “Design Practices Manual.”

B. Manufacturer Qualifications: A qualified manufacturer.

1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

C. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

D. Installer Qualifications: Installers and supervisors who are trained and certified by roof system manufacturer. Installer must have 5 years’ minimum experience installing standing-seam metal roofs. Certified installer must be on the job while roof is being installed.

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.12 FIELD CONDITIONS

A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.13 WARRANTY

A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

1. The State of Missouri is prohibited by law from entering into binding arbitration. No warranty shall be submitted with any arbitration clause.

B. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty years from date of Substantial Completion.
3. Painted panels and their finishes shall carry a 20-year material, Extended-Life Endorsement if not already included as part of the weathertightness warranty. Warranty

shall be executed by both the roof system manufacturer and the roofing contractor (Installer). Warranty shall be from date of Substantial Completion.

C. Special Weathertightness System Warranty for Standing-Seam Metal Roof Panels: System manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period. Warranty shall be non-prorated, shall include all labor and materials and shall cover all roof curbs, jacks, and any other roof penetrations.

1. Warranty Period: Twenty years from date of Substantial Completion.

D. Roofing Installer's Warranty: Submit roofing installer's warranty (on warranty form at end of this Section), signed by installer, guaranteeing complete installation and any area of work not covered by roof system warranty including, but not limited to, roofing, insulation, fasteners, flashings, penetrations, curbs, accessories, etc.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Butler Manufacturing Company; a division of BlueScope Buildings North America, Inc.
2. Nucor Building Systems (A Nucor Company).
3. Varco-Pruden Buildings; a division of BlueScope Buildings North America, Inc.
4. Subject to compliance with requirements, other manufacturers offering products that may be incorporated into the Work

B. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

B. Primary-Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of load-bearing end-wall and corner columns and rafters.

D. Secondary-Frame Type: Manufacturer's standard purlins and partially inset-framed girts.

E. Eave Height: Manufacturer's height, as necessary to meet eave height, as indicated on Drawings.

F. Bay Spacing: As indicated on Drawings.

G. Roof Slope: 3 inches per 12 inches.

H. Roof System: Manufacturer's standing-seam, trapezoidal-rib metal roof panels.

I. Exterior Wall System: Manufacturer's standard exposed-fastener, tapered-rib, metal wall panels similar to the depth and profile of existing metal wall panels of barracks building located on site (located to the east of Project site).

J. Interior Wall System: Liner panels located at the interior side of the exterior walls and columns.

K. Insulation: Consisting of batt insulation, roof insulation, wall insulation, vapor barrier liner, thermal breaks, straps, mastic and other devices and components necessary to meet the performance requirements of the Specifications.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.

B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated on Drawings and including UFC 1-200-01, UFC 4-010-01, etc.
2. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
3. Deflection and Drift Limits: No greater than the following:

    a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
    b. Girts: Horizontal deflection of 1/240 of the span.
    c. Metal Roof Panels: Vertical deflection of 1/150 of the span.
    d. Metal Wall Panels: Horizontal deflection of 1/240 of the span.
    e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
    f. Lateral Drift: Maximum of 1/200 of the building height.

C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and UFC 3-310-04.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

E. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E119 or ASTM E108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.

F. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.

G. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06-cfm/sq. ft. when tested according to ASTM E1680 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

H. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06-cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

I. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

J. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

K. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

L. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail Resistance: SH.

M. Thermal Performance for Opaque Elements: Provide the following maximum assembly U-factors for insulation when tested according to ASTM C1363 or ASTM C518:

1. Roof: Filled Insulation Cavity with Thermal Spacer Blocks.

   a. Overall Assembly U-Factor: U-0.037.

2. Walls: Single-Layer Insulation in Cavity with Thermal Spacer Blocks.

   a. Overall Assembly U-Factor: U-0.059.

2.4 STRUCTURAL-STEEL FRAMING

A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."

B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse frames; rafters, rake, and canopy (eave overhangs) beams; sidewall, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

   a. Slight variations in span and spacing may be acceptable if necessary, to comply with manufacturer's standard, with prior approval by Architect. Contractor shall notify Architect specific variations and submit to Architect for review and approval.

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.

E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch-wide flanges.

    a. Depth: As needed to comply with system's structural and insulating performance requirements.

2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch-wide flanges.

    a. Depth: 8 inches.
    b. If structural members are larger than those anticipated in the Contract Drawings, Contractor shall notify the Architect immediately and the Contractor shall coordinate the work and adjust all dimensions with actual size of structural members at no additional cost to the owner.

3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch-diameter, cold-formed structural tubing to stiffen primary-frame flanges.
5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch, fabricated from zinc-coated (galvanized) steel sheet.
7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members. Provide necessary height of clips to accommodate insulation requirements.
8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

G. Canopy Framing (Eave Overhangs): Manufacturer's standard structural-framing system, designed to withstand required loads; fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.

1. Type: As indicated.

H. Bracing: Provide adjustable wind bracing using any method as follows:

1. Rods: ASTM A36/A36M; ASTM A572/A572M, Grade 50; or ASTM A529/A529M, Grade 50; minimum 1/2-inch-diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
2. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
3. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.

I. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.

J. Materials:

1. W-Shapes: ASTM A992/A992M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
3. Plate and Bar: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
4. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.
6. Structural-Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A1008/A1008M, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.
7. Metallic-Coated Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.
8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.
    b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, SS, Grade 50 or 80; with Class AZ50 coating.

9. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.

    a. Finish: Plain.

10. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

a. Finish: Plain.

11. Unheaded Anchor Rods: ASTM F1554, Grade 36.

a. Configuration: Straight.
b. Nuts: ASTM A563 heavy-hex carbon steel.
c. Plate Washers: ASTM A36/A36M carbon steel.
d. Washers: ASTM F436 hardened carbon steel.
e. Finish: Hot-dip zinc coating, ASTM F2329, Class C.

12. Threaded Rods: ASTM A36/A36M.

a. Nuts: ASTM A563 heavy-hex carbon steel.
b. Washers: ASTM A36/A36M carbon steel.
c. Finish: Plain.

K. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Clean and prepare in accordance with SSPC-SP2.
2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.

a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2.5 METAL ROOF PANELS

A. Standing-Seam, Trapezoidal-Rib, Metal Roof Panels: Machine-seamed, double-lock, roll-formed with raised trapezoidal ribs at panel edges and intermediate striations symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under 1 side of panels and engaging opposite edge of adjacent panels. Panels shall include side lap sealant.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

a. Exterior Finish: Two-coat fluoropolymer.
b. Color: As selected by Architect from manufacturer's full range.

2. Clips: Two-piece floating to accommodate thermal movement.
3. Joint Type: Mechanically seamed.
4. Panel Coverage: 24 inches.
5. Panel Height: 3 inches.
6. Uplift Rating: UL 90.
7. Panel profile shall match existing per Article 2.2 SYSTEM DESCRIPTION.

B. Finishes:

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.6 METAL WALL PANELS

A. Exposed-Fastener, Reverse-Rib, Metal Wall Panels: Formed with recessed, trapezoidal major valleys and intermediate stiffening valleys symmetrically spaced between major valleys; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

a. Exterior Finish: Fluoropolymer.
b. Color: As selected by Architect from manufacturer's full range.

2. Major-Rib Spacing: 12 inches on center.
3. Panel Coverage: 36 inches.
4. Panel Height: 1.25 inches.
5. Panel profile shall match metal wall panels of existing per Article 2.2 SYSTEM DESCRIPTION.

a. Field verify for the profile of the exterior walls, roof, trim and soffit panels.

B. Finishes:

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.7 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of existing metal wall panels per Article 2.2 SYSTEM DESCRIPTION.

1. Finish: Match finish and color of metal wall panels.

2.8 THERMAL INSULATION

A. Faced Metal Building Insulation: ASTM C991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch-wide, continuous, vapor-tight edge tabs; with a flame-spread index less than 25.

B. Unfaced Metal Building Insulation: ASTM C991, Type I, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; with a flame-spread index of less than 25; and smoke-developed index of less than 50.

C. Thermal Blocks (Roof): High density, 1-inch-thick extruded polystyrene, for installation over the roof purlin.

D. Thermal Blocks (Wall): Minimum R-0.375 thermal spacer block or thermal break strip.

E. Retainer Strips: For securing insulation between supports, 0.025-inch nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

F. Vapor-Retarder Facing: ASTM C1136, with permeance not greater than 0.02-perm when tested according to ASTM E96/E96M, Desiccant Method.

1. Composition: Aluminum foil facing, elastomeric barrier coating, fiberglass scrim reinforcement, and kraft-paper backing.

G. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.9 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
2. Clips: Manufacturer's standard, formed from stainless-steel sheet, designed to withstand negative-load requirements.
3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from stainless-steel sheet.
4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including fasciae, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.030-inch nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

1. Gutter Supports: Fabricated from same material and finish as gutters.
2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters.

G. Roof Curbs: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch nominal uncoated steel thickness prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.

1. Curb Subframing: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch nominal uncoated steel thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
2. Insulation: 1-inch-thick, rigid type.

H. Materials:

1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.

a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
b. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM sealing washers bearing on weather side of metal panels.
c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
d. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

4. Metal Panel Sealants:

   a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
   b. Joint Sealant: ASTM C920; 1-part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.10 INTERIOR LINER (WALL) PANELS

A. Interior Wall System:

1. Liner Panels (located at the interior side of the exterior walls and columns):

   a. Fasteners: Concealed
   b. Profile: Flush
   c. Texture: Smooth
   d. Thickness: 24-gauge
   e. Color: Match adjacent gypsum walls.
   f. Finish Performance Requirements: Match exterior metal wall panels.

2.11 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.12 SOURCE QUALITY CONTROL

A. Special Inspection: Owner may engage a qualified special inspector to perform source quality control inspections and to submit reports.

1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.

a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written instructions and drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than 7 days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.

a. Joint Type: Snug tightened or pretensioned as required by manufacturer.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: On-site panel fabrication is prohibited.

C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.

2. Install metal panels perpendicular to structural supports unless otherwise indicated.

3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets 1 full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

1. Install ridge caps as metal roof panel work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.

1. Install clips to supports with self-drilling or self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
4. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.

5. Provide metal closures at rake edges, rake walls and each side of ridge caps.

C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

D. Night Seals or Night Tie-Offs: At the end of each day's work, seal off roof construction to prevent water penetration into new roof system.

3.6 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When 2 rows of metal panels are required, lap panels 4 inches minimum.
4. When building height requires 2 rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

3.7 METAL SOFFIT PANEL INSTALLATION

A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.

B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.8 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward winter warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in 1-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
2. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.

    a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

3. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.

1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.9 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather-resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches on center using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center in between.

1. Provide elbows at base of downspouts to direct water away from building or tie downspouts to underground drainage system where indicated in the Drawings.

E. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.10 FIELD QUALITY CONTROL

A. Special Inspections: Owner may engage a qualified special inspector to perform field quality control special inspections and to submit reports.

B. Product will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Arrange for final roof system inspection through the roofing system manufacturer’s technical personnel in order to inspect the roof system upon completion. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

3.11 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.

1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.12 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <NAME> of <ADDRESS>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following Project:

1. Owner:
2. Address:
3. Building Name/Type:
4. Address:
5. Area of Work:
6. Acceptance Date:
7. Warranty Period:
8. Expiration Date:

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

   a. Lightning,
   b. peak gust wind speed exceeding 72 mph,
   c. fire,
   d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition,
   e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work,
   f. vapor condensation on bottom of roofing; and
   g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof has been paid by Owner or by another responsible party so designated.

2. The Roofing Installer is responsible for damage to work covered by this Warranty.
3. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void, unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
4. The Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
5. This Warranty is recognized to be the installation warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <DAY> day of <MONTH>, <YEAR>.

1. Authorized Signature:
2. Name:
3. Title:

END OF SECTION 133419

SECTION 21 01 00 - GENERAL FIRE SUPPRESSION REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The Fire Protection Contract includes all labor, materials and equipment required for the complete fire suppression system(s) as shown and herein specified.

1.02 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, General Requirements (Division 1) and Section 26 01 13 - Electrical Connections, apply to the work specified in DIVISION 21 – FIRE SUPPRESSION.

1.03 DESCRIPTION OF WORK

A. The fire protection contract includes all labor, materials and equipment required for the complete fire suppression system(s) as shown and herein specified.

B. Provide all devices and accessories as necessary for complete and working systems.

C. The contractors shall become familiar with the work of all other trades and shall fully coordinate their work prior to ordering equipment or installation of systems.

1.04 QUALITY ASSURANCE

A. Each major component of equipment shall have the manufacturer's name; address, model number and rating on a nameplate securely affixed.

B. All equipment of one type (such as heads, pumps, valves, etc.) shall be the products of one manufacturer, unless otherwise specified.

C. In the event of discrepancies between the drawings and specifications, the contractor shall advise the engineer before proceeding with the work in order that correct progress is ensued.

D. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel." Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.05 SHOP DRAWINGS AND SUBMITTALS

A. Shop drawings shall be submitted as specified in Division 1. Product data shall be submitted for all materials and equipment specified in DIVISION 23. Shop drawings and submittals must be submitted in PDF format and emailed to the design team.

B. Shop drawings for equipment ‘Packages” shall be complete and include all items to be provided by a manufacturer’s representative or supply house. No partial submittals will be reviewed or approved without a complete and total equipment submittal.

C. Each shop drawing shall include a letter indicating all deviations from the drawings and/or specifications.

D. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:

1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
2. Capacity, pressure drop, rpm, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
3. Dimensional drawings showing layout, connection points, and detailed layout of components.

4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.
5. Conspicuously mark on each submittal the exact model, fittings, accessories, and devices to be supplied. When a schedule is shown on the drawings or in the specifications, provide a copy of that schedule with the shop drawing indicating the equipment capacities and characteristics of the actual equipment being proposed.
6. Tags for equipment submitted shall match the tags indicated on the design drawings or specifications. Where equipment is noted on the drawings and not scheduled, refer to plan note and sheet number on the submittal.

E. Contractor shall check all shop drawings to verify that they meet the requirements of the drawings and specifications before forwarding to the architect and engineer. All shop drawings submitted shall bear the stamp of the contractor to show that they have been reviewed in detail.

F. No work shall be fabricated and no equipment ordered until the architect and engineer have returned acceptable reviewed shop drawings.

G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this section.

1.06 PROJECT SEQUENCING

A. The contractor shall refer to the architectural plans and specifications for areas of work and general schedules to determine the scope of work required during each phase of the construction.

B. All temporary valves, etc. not indicated, but required by phasing, shall be included in the base bid.

1.07 SUBSTITUTIONS

A. The materials, products, and equipment described in these specifications or on the drawings establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. Listing of these manufacturers shall in no way be construed as a device intended to limit the bidders to those specifically listed.

B. Reference to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number, shall be interpreted as having established a standard of quality and shall not be construed as limiting competition. Articles, fixtures, etc. of equal quality by manufacturers listed in this specification for the applicable use, shall be acceptable, subject to performance, spatial, structural, and electrical constraints of the project design.

C. The Engineer reserves last opinion as to a product's equality or superiority to that specified.

1.08 DEFINITIONS

A. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

B. Install: The term "install" is used to describe operations at the project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

C. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

D. Furnished by Owner or Furnished by Others: The item will be furnished by the Owner or Others. It is to be installed and connected under the requirements of this Division, complete and ready for operation, including all items incidental to the Work, including all services necessary for proper installation and operation. The Installation shall be included under the guarantee required by this Division.

The design engineer, referred to as "engineer" shall mean the engineering firm, HOSS & BROWN ENGINEERS, INC., Contact person: Brandon Frey.

1.09 OPERATION AND MAINTENANCE MANUALS

A. Three (3) Flash Drives containing PDFs of Operation and Maintenance (O&M) Manuals shall be submitted as described below. Files and folder names shall be clearly labeled. Folder structure and names shall be intuitive and clearly labeled.

B. Before project close-out, submit O&M operating, maintenance instructions, and parts lists for equipment provided. Include in the manual a list of emergency service organizations capable of rendering service for each piece of equipment. Include in the manual a set of as-built prints.

C. Keep in a safe place all keys, wrenches, and other specialty tools furnished with equipment. Present to owner at project close-out and receive a receipt showing he has received the same.

D. At the completion of the project furnish to the Architect for the Owner O&M brochures divided and tabbed, containing all data, diagrams, as-built plans, capacities, spare part numbers, manufacturers service and maintenance data, warranties, guarantees, etc., including local contacts and escalation schedule complete with addresses and telephone numbers, of all equipment, apparatus, and system components furnished and installed under this Division of the specifications.

1.10 CODES AND ORDINANCES

A. All work shall be in accordance with applicable codes, rules, ordinances, and regulations of local, state, and federal governments and other authorities having jurisdiction.

B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard, to any ordinances, laws, codes, rules, or regulations bearing on work, the contractor shall execute work in accordance with such without increased cost to the owner, but not until he has referred such variances to the engineer.

C. The contractors shall secure and pay for the necessary permits and certificates of inspection for their trade. Keep record of all permits and inspections and submit two copies to the engineer with request for final inspection.

1.11 OWNER TRAINING

A. Contractor shall demonstrate to the owner that all systems installed under this division of the specifications are complete and operating as intended.

B. Any adjustments or other additional work required as a result of failure of any system to comply with the intent of this specification shall be accomplished at no additional cost to the Owner.

1.12 WARRANTY

A. This contractor shall warrant that the complete systems installed under this contract shall be free of defects in workmanship and materials for a period of one (1) year from the date of substantial completion by the arch/owner.

B. If defects occur during the one year guarantee period, this contractor shall repair or replace such defects at no expense to the owner and to the satisfaction of the owner and engineer.

PART 2 PRODUCTS

2.01 GENERAL

A. Where the quality of required material is not specified, the Contractor shall furnish a first class standard item as approved by the Architect/Engineer.

B. Capacities of equipment and materials shall not be less than those indicated.

C. All work performed shall provide a neat and workmanlike appearance when completed, to the satisfaction of the engineer.

D. Provide 3-1/2" concrete base for all floor mounted equipment unless shown or noted otherwise. Provide 6x6 welded wire fabric reinforcing minimum or as required by the structural engineer.

E. Adequately protect equipment from damage after delivery to the jobsite. Cover with heavy polyethylene plastic. Elevate equipment when there is danger of water damage. Equipment damaged will be rejected.

F. Any scratches to factory finishes shall be touched up using factory supplied paint before final acceptance. If extensive damage to factory finishes has occurred, equipment panels shall be replaced to the satisfaction of the engineer. If rust has formed, remove as recommended by the manufacturer prior to touch-up.

2.02 EQUAL PRODUCTS OF LISTED MANUFACTURERS

A. In general, the specifications and drawings identify required materials and equipment by naming first the manufacturer whose product was used for the basis of design. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality, construction and dimensional requirements for comparing the other manufacturer's products. The capacity and performance of all equipment shall meet or exceed what is indicated on the drawings and/or scheduled.

B. Where other manufacturer's names are listed, they are considered an acceptable manufacturer for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers have been shown.

C. Where other than first named products are used, it shall be the responsibility of the contractor to determine prior to bid time that his proposed materials and equipment selections do not require adjustments in the mechanical, electrical , structural, or architectural requirements as shown on the drawings. The contractor shall include in his bid all costs associated with any required adjustments.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all equipment in strict accordance with NFPA requirements, the manufacturer's recommendations, and the shop drawings reviewed by the Engineer.

B. The complete installation shall function as designed and intended with respect to efficiency, capacity, and noise level, etc. Any abnormal noise caused by rattling equipment, piping, ducts, conduit, air devices, or squeaks in rotating equipment will not be acceptable

C. Locations of equipment, piping, and other work are indicated diagrammatically on the drawings. Each contractor shall coordinate exact locations subject to structural conditions, work of other contractors, access requirements, and the approval of the architect and engineer.

D. Any item interfering with proper placement of other work shall be removed and relocated without extra cost if reasonable coordination would have eliminated the interference. Damage to other work caused by this contractor shall be restored as specified for new work.

E. Written dimensions are preferred over scaled dimensions. When written dimensions are not available, the contractor shall be responsible for determining the proper installed location.

F. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification.

G. Contractor shall perform initial start-up of systems. Owner's operating personnel shall be present during this operation.

H. It is the contractor's responsibility to provide materials and trim which properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.

I. This contractor shall provide all miscellaneous steel, etc., for the proper installation of the systems specified and/or indicated on the plans.

3.02 CONNECTIONS TO BUILDING STRUCTURE

A. Any item connecting to building structure shall be done in a manner accepted by the structural engineer.

B. When bar joists are used for steel construction, items shall be supported from angle iron spanning the top chord of the joists.

3.03 CLEANING

A. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.

3.04 EXISTING UTILITIES

A. Locate and mark all known utilities prior to proceeding with work. Proceed with caution since unmarked utilities may exist on site.

B. Should any existing utilities be damaged or disrupted, immediately notify Owner and repair to existing conditions.

C. The Contractor shall closely coordinate all utility downtime with the Owner and Architect giving a minimum fourteen (14) day notice prior to downtime.

D. Downtimes are to be held to a minimum duration with the Owner being notified as to the extent of said downtime.

End of Section 21 01 00

SECTION 21 05 13 - ELECTRICAL PROVISIONS OF FIRE SUPPRESSION WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The contractors responsible for Division 21 work shall coordinate with the Electrical Contractor to insure motor starters of the proper size are furnished. Further, the Fire Protection Contractor shall furnish all electric control items indicated to the Electrical Contractor for installation and connection, unless noted otherwise.

PART 2 PRODUCTS

2.01 MOTOR STARTERS AND CONTROLLERS

A. The Fire Protection Contractor shall provide all motor starters and controllers required for equipment provided in the fire suppression contract that is not integral with equipment.

PART 3 EXECUTION

3.01 MOTOR STARTERS AND CONTROLLERS

A. The Fire Protection Contractor shall coordinate all motor starters type and size with the Electrical Contractor to insure compatibility with the motors provided in this contract.

ITEM	Furnished By	Set By	Power Wiring	Control Wiring
Pumps	FPC	FPC	EC	EC
Flow switches, alarms, interlocks, etc.	FPC	FPC	EC	EC
Air compressor, pressure switches, interlocks, etc	FPC	FPC	EC	EC

FPC = Fire Protection Contractor
EC = Electrical Contractor

End of Section 21 05 13

SECTION 21 05 14 - SERVICES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the services as shown on plans and specified.

1.02 EXISTING CONDITIONS

A. Locate and mark all known utilities prior to proceeding with work. Proceed with caution since unmarked utilities may exist on site.

B. Should any existing utilities be damaged or disrupted, immediately notify Owner and repair to existing condition.

1.03 UTILITY FEES

A. The Contractor shall pay any and all required utility service fees associated with this project.

1.04 UTILITY CONNECTION COORDINATION

A. The Contractor shall contact and coordinate all aspects of the utility connections outlined and shown hereinafter.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 FIRE PROTECTION

A. Contractor shall refer to Civil drawings for requirements for connection of new service to existing water utility main indicated and shall bring service to building.

End of Section 21 05 14

SECTION 21 05 15 – FIRE SUPPRESSION RELATED WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The following is the work required by the General Contractor to facilitate the work of the Fire Protection Contractor.

1. Openings and chases.

B. The following is the work required by the Fire Protection Contractor to facilitate the work of his Contract.

1. Cutting and patching
2. Excavation and backfilling
3. Pipe sleeves

1.02 RELATED DOCUMENTS

A. Refer to Division 31 for backfilling requirements.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 GENERAL CONTRACTOR'S WORK

A. The General Contractor shall leave such openings and chases in new construction for pipes, cabinets, access doors, and equipment as may be necessary or directed by the Architect to facilitate the work of the Fire Protection Contractor and to refinish around same. The Fire Protection Contractor shall properly advise in due time as to the location and sizes of such openings and chases.

3.02 FIRE PROTECTION CONTRACTOR'S WORK

A. The Fire Protection Contractor shall be responsible for locating and setting his own pipe sleeves, and be well aware of the job progress to avoid unnecessary delay for setting of same.

B. The Fire Protection Contractor shall be responsible for cutting his own holes in existing construction and for patching and finishing around same, unless noted otherwise, to the satisfaction of the Architect. Any holes left in walls when existing pipe is removed by this Contractor shall be patched and finished by this Contractor.

C. The Fire Protection Contractor shall do all excavating and backfilling necessary to complete work under this contract. Lines shall be used to lay out the trenches for underground work. Trenches shall be of sufficient width and shall be cribbed or braced to prevent cave-in or settlement. Trenches close to walls and columns of the building shall not be excavated without the Architect's prior consent. The bottoms of trenches shall be tamped hard and graded to secure the required fall before laying pipe. Bell holes shall be excavated so the pipe will rest on solid ground for its entire length.

D. Hand backfill and tamp backfill into place at sides of pipes, leaving tops and joints exposed until pipe runs have been tested and approved.

E. All sidewalks, streets, or alley surfaces that have to be broken in connection with this contract shall be patched to the satisfaction of the Architect. End of Section 21 05 15

SECTION 21 05 16 - EXPANSION COMPENSATORS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide expansion compensators as specified and as indicated on the drawings.

B. Provide flexible pipe expansion compensators with guides as per manufacturer's recommendations. Bellows-type and slip type compensators are not acceptable

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the specification is Metraflex and shall represent the minimum level of construction. Products manufactured by Flexicraft, US Bellows, Mason Industries, and Hunter shall be permitted to bid these specifications

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 EXPANSION JOINTS

A. Provide Metraflex, "Metraloops", or approved equal, flexible loop type compensators constructed of two flexible sections of hose and braid, two 90° elbows and one 180° return bend.

B. Expansion compensators shall impart minimal thrust loads to anchors and shall be installed in a neutral, precompressed or pre-extended condition as required by installation temperatures.

C. Compensators shall be guided to direct movement into the Metraloop or approved equal. One guide will be required within four pipe diameters on either side of the compensator.

D. The compensator shall be supported at the 180° turn bend installed in the horizontal plane. No support is required if installed in the vertical plane.

E. Compensators in steel system shall be stainless steel hose and braid with threaded, grooved, or flanged ends:

LINES	SERIES
½" to 2"	MLT or approved equal rated for 4" movement
2½" & larger	MLF , MFW or MFG or approved equal rated for 4" movement

PART 3 EXECUTION

3.01 INSTALLATION

A. Each compensator shall be installed in strict compliance with manufacturer's recommendations.

End of Section 21 05 16

SECTION 21 05 17 – FIRESTOPPING FOR FIRE SUPPRESSION SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested firestop systems shall be used in specific locations as follows:

1. Penetrations for the passage of piping and other fire suppression equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
2. Repetitive penetrations in fire-rated floor assemblies.

1.04 REFERENCES

A. Test Requirements: ASTM E-814-02, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 (August 24,2000) and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. The UL Fire Resistance Directory includes the following:

1. Firestop Devices (XHJI)
2. Fire Resistance Ratings (BXUV)
3. Through-Penetration Firestop Systems (XHEZ)
4. Fill, Voids, or Cavity Material (XHHW)
5. Forming Materials (XHKU)

C. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

D. Inspection Requirements: ASTM E 2174 – 01, “Standard Practice for On-site Inspection of Installed Fire Stops.”

E. ASTM E-84-01, “Standard Test Method for Surface Burning Characteristics of Building Materials.”

F. All major building codes: ICBO, SBCCI, BOCA, and IBC.

G. NFPA 101 - Life Safety Code

1.05 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E-814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.

1.06 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's UL approved installation instructions.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor's name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.07 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engauged by the Contractor does not in itself confer qualification on the buyer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.09 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Scheduling

1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, Phone 800-879-8000
2. STI Firestop
3. 3M Fire Barrier Products.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 FIRESTOPPING, GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device or approved equal: Add Aerator adaptor when used in conjunction with aerator (“sovent”) system.
2. Hilti CP 681 Tub Box Kit or approved equal, for use with tub installations.

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe and copper pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant or approved equal
2. Hilti CP 604 Self-leveling Firestop Sealant or approved equal
3. Hilti CP 620 Fire Foam or approved equal
4. Hilti CP 606 Flexible Firestop Sealant or approved equal
5. Hilti CP 601s Elastomeric Firestop Sealant or approved equal

D. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant or approved equal

E. Firestop collar or wrap devices attached to assembly around combustible plastic pipe, the following products are acceptable:

1. Hilti CP 642 Firestop Collar or approved equal
2. Hilti CP 643 Firestop Collar or approved equal
3. Hilti CP 645 Wrap Strips or approved equal

F. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

PART 3 EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
2. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROLS

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating

of existing firestop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

End of Section 21 05 17

SECTION 21 05 19 - METERS AND GAUGES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide gauges as specified.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Provide devices by one of the following manufacturers.

1. Marshalltown
2. Trerice
3. Weiss Instruments
4. Weksler Instruments

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 PRESSURE GAUGES

A. Provide dial type with enameled steel or cast aluminum case, white dial, case relief vent, recalibration device and AISI 316 stainless steel Bourdon tube, tip and socket.

B. Gauges shall be installed with brass pipe fittings, unions, gauge cock, and pulsation dampers.

C. Unless indicated otherwise, ranges on gauges shall be as follows:

1. 0-160 psi - water service entrance
2. 0-100 psi – within sprinkler system

PART 3 EXECUTION

3.01 INSTALLATION OF PRESSURE GAUGES

A. Install in the following locations, and elsewhere as indicated:

1. At building fire protection water service entrance.

End of Section 21 05 19

SECTION 21 05 23 - PIPING SPECIALTIES AND VALVES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Valves shall be installed at locations shown and specified; the locations shall be accessible. All valves shall be installed with their stems or spindles horizontal or above.

B. Provide unions or grooved mechanical couplings where shown at all equipment connections and at other points where disconnection of piping will be required.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the valve specification is Nibco and MEPCO and shall represent the minimum level of construction. Equipment manufactured by NVent, Apollo, Milwaukee, and Victaulic shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 VALVES

A. Butterfly valves rated 300 psi working pressure, grooved end or lug style, ductile iron body with 2” extended neck for insulation, and 10 position lever shall be used in 4" and larger copper and steel lines for all fire protection duties. Valves to have electroless nickel coated ductile iron or aluminum bronze disc with pressure responsive EPDM synthetic rubber seat, 400 series stainless steel stem and shall not have exposed stem to disc fasteners. (Stem shall be offset from the disc centerline to provide full 360-degree circumferential seating.) Valves to be rated at full pressure rating for dead end bi-directional service. Valves to be manufactured in compliance with MSS-SP 67. Provide with isolating flanges when used in copper lines. NIBCO LD2000-3 (4” thru 6”) or approved equal, NIBCO LD 2000-5 (8” thru 12”) or approved equal, and Victaulic Vic-300 MasterSeal™ or approved equal when using grooved end valves through 12”. Victaulic Series W706 or approved equal shall be used for grooved end piping systems 14” through 24”.

B. Y-pattern swing-type check valve manufactured in accordance with MSS-SP 80, Class 150 psi B62 cast bronze body shall be used in 2 1/2" and smaller lines for fire protection duties. NIBCO T-433Y or approved equal. Victaulic Series 712 or approved equal when using grooved end valves.

C. Swing-type check valve manufactured in accordance with with MSS-SP 71, class 125, grooved ASTM A536 ductile iron or flanged ASTM A126 class B cast iron body with bronze trim or wafer-style with stainless steel spring, bronze disc plates, rubber seat and cast iron body, shall be used in 3" and larger lines for fire protection duties. NIBCO T-433Y or approved equal. For vertical line applications use NIBCO T-480 or approved equal. When using grooved end valves, Victaulic Series 712 or approved equal swing check valve for horizontal installations, Victaulic Series 716 or approved equal, or Victaulic Series W715 or approved equal for vertical or horizontal installations.

2.03 DOUBLE CHECK STYLE BACKFLOW PREVENTERS WITH DETECTORS - ½" THROUGH 10" (FIRE PROTECTION)

A. Provide Ames C300 or C300N, or approved equal, double check detector valve assembly where indicated to create potable and non-potable water system and protect main service line. Backflow

device shall be FM listed for fire protection use.

B. Double check assembly shall consist of two independent Tri-link Check modules within a single housing with sleeve access port, four test cocks, and two drip tight shutoff valves. Tri-Link Checks shall be removable and serviceable without the use of special tools.

C. Housing and valve bodies and cover shall be manufactured of stainless steel and shall be designed to 175 psi cold water working pressure at a temperature range of 33 F to 110 F.

D. Tri-Link Checks shall have reversible elastomer discs and in operation shall produce a drip tight closure against the reverse flow of liquid caused by back pressure or backsiphonage.

E. The by-pass meter assembly shall consist primarily of a bronze water meter in series with a bronze double check valve. The meter shall be the total registration type with accurate registration between 1 and 20 GPM flow rates. The by-pass double check shut-off valves and testcocks shall be resilient seated ball valves with full flow characteristics.

2.04 UNIONS

A. Threaded type ground joint unions shall be used on piping 2" and smaller. Flanged connections shall be used on pipe 2½" and larger.

B. Unions are not required in installations using Victaulic or approved equal grooved mechanical couplings.

C. Unions shall not be installed in walls or partitions or above non-accessible ceilings.

D. Pressure ratings on unions shall be equal to or greater than the lines they are in.

E. Dielectric unions or Victaulic Style 47 or approved equal dielectric waterway fittings shall be used where copper lines connect to other types of materials.

PART 3 EXECUTION

End of Section 21 05 23

SECTION 21 05 29 - PIPING SUPPORTS, ANCHORS, AND SEALS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide piping support, anchors, and seals as specified and indicated on drawings.

B. Pipe shall not pass through footings or beams without the consent of the Architect.

1.02 SUBMITTALS

A. Shop drawings of the fire-stopping method shall be approved prior to the setting of any sleeves and shall clearly define the UL fire-stopping method and required sleeve clearances.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification is B-Line Systems Inc. and shall represent the minimum level of construction. Equipment manufactured by Erico and Grinnell shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 HANGERS AND SLEEVES

A. Pipe hangers for lines 1/2” to 2” shall be adjustable swivel ring hanger equal to B-Line Figure B-3170NF and B-3170CT or approved equal, for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger swivel rings. Upper ends supported as hereinafter specified with the proper B-Line or approved equal, upper attachments.

B. Pipe hangers for lines 2 1/2” to 4” shall be light duty clevis hanger equal to B-Line Figure B-3104 and B-3104CT or approved equal, for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger rod holes. Upper ends supported as hereinafter specified with the proper B-Line or approved equal, upper attachments.

C. Pipe hangers for lines 6” and larger shall be standard clevis hanger equal to B-Line figure B3100 and B3100C or approved equal, for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger rod holes. Upper ends supported as hereinafter specified with the proper B-Line or approved equal, upper attachments.

D. Provide B-Line Figure B-3373 and B-3373CT or approved equal, riser clamps for ferrous and copper piping, respectively, at each floor and at other locations where vertical support is necessary.

E. Pipe sleeves will be required in all pipe and duct penetrations through new exterior walls, masonry walls, floors and fire rated gyp. board walls. Sleeves shall be either Schedule 5 steel pipe, field fabricated from minimum 16 gauge steel with 2" overlap at the seam, or as required by U.L. listed fire-stopping system.

F. Pipe sleeves will not be required in existing wall penetrations of masonry construction when such openings are made by "core-drilling".

PART 3 EXECUTION

3.01 PIPE SLEEVES

A. Space between sleeves and pipes in outside walls shall be filled or tightly caulked with oakum,

butyl rubber, link seals or other approved equally effective material to resist the penetration of water. Pipe sleeve shall be sufficient diameter to provide approximately 1/2" clearance around pipe, and in the case of insulated pipe, approximately 1/2" around insulation.

B. Space between sleeves and pipes in other wall construction shall be diameter as required to provide the clearance required by the U.L. listed fire-stopping method chosen by the Contractor.

C. Sleeves shall be set no closer than three pipe diameters center to center, be set 3/4" past all wall surfaces, and securely anchored to the wall.

3.02 PIPE HANGERS

A. Upper ends of hanger rods in steel structures shall be supported angle iron laid across top chord of bar joists, or from side beam clamps.

B. Upper ends of hanger rods other constructions shall be supported as approved by the Structural Engineer of record.

C. Hanger and support spacing for horizontal steel and copper piping shall not exceed the values given in the following table, unless noted otherwise:

NOMINAL PIPE SIZE	STEEL PIPE	COPPER PIPE
1/2" - 1-1/4"	7'	5'
1-1/2" - 2"	9'	6'
2-1/2" - 3"	11'	10'
4"	14'	10'
6"	17'	--
8"	19'	--
10" - 12"	22'	--

D. Fire protection piping shall be supported in accordance with NFPA requirements.

E. Spacing of supports and braces for exposed vertical piping shall not exceed the hanger spacing specified for horizontal pipe, unless otherwise indicated.

End of Section 21 05 29

SECTION 21 05 53 – FIRE PROTECTION IDENTIFICATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide fire protection identification as specified and indicated on the drawings.

B. This Section includes the following mechanical identification materials and their installation:

1. Equipment markers
2. Access panel and door markers
3. Pipe markers
4. Valve tags
5. Valve schedules

1.02 SUBMITTALS

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

B. Valve Schedules: Provide valve numbering scheme and identification type for each piping system. Furnish extra copies (in addition to mounted copies) to include in Operation and Maintenance Manuals.

1.03 COORDINATION

A. Coordinate installation of identifying devices with completion of insulation and jacketing surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:

1. Seton
2. Brady
3. Craftmark
4. Brimar Industries, Inc.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Markers: Engraved, color-coded laminated plastic.

1. Terminology: Match schedules as closely as possible.
2. Data:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
3. Size: 2-1/2” by 4” for control devices, dampers, and valves; 4-1/2” by 6” for equipment.
4. Letter Size: Minimum 1/4 “ for name of units if viewing distance is less than 24 inches, 1/2“ for viewing distances up to 72 inches and proportionately larger lettering for greater

viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

B. Access Panel and Door Markers: 1/16" thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8" holes for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.03 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ANSI/ASME A13.1, unless otherwise indicated.
2. Type and Size of Letters: Comply with ANSI/ASME A13.1, unless otherwise indicated.
3. Legends: Spelled out in full or commonly used and accepted abbreviations.
4. Pipes with OD, Including Insulation, Less Than 6": Full-band pipe markers extending 360 degrees around pipe at each location.
5. Pipes with OD, Including Insulation, 6" and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
6. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semi rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semi rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

2.04 VALVE TAGS

A. Valve Tags: Stamped or engraved with ¼" letters for piping system abbreviation and ½" numbers, with numbering scheme to match existing numbering scheme on temperature control drawings. Provide 5/32" hole for fastener.

1. Material: 3/32" thick laminated plastic with 2 black surfaces and white inner layer.
2. Valve-Tag Fasteners: Brass beaded wire-link chain, beaded chain or S-hook.
3. Valve tag size and shape: 1 ½" round.

2.05 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on temperature control drawings), location of valve (room or space), normal-operating position (open, closed, or modulating) and variations for identification. Mark valves for emergency shutoff and similar special uses.

B. Valve-Schedule Frames: Glazed display frame for removable mounting on walls for each page of valve schedule. Include mounting screws.

C. Frame: Extruded aluminum.

D. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.06 EQUIPMENT LOCATORS ON CEILING

A. Provide ¼" round colored dot stickers (as available at office supply stores) on ceiling grid for locating equipment and valves. Adhere stickers to the ceiling grid as close to each piece of equipment as possible. Colors shall be as follows.

1. Zone/Isolation water valves Red

B. Approval shall be obtained from Architect prior to applying dots.

PART 3 EXECUTION

3.01 EQUIPMENT IDENTIFICATION

A. Install equipment markers on or near each piece of plumbing equipment.

B. All equipment shall be labeled as directed by the owner or as designated on the drawings if the owner has no other preference.

C. Locate equipment markers where accessible and visible. Include markers for the following general categories of equipment:

1. Main control and operating valves including safety devices.
2. Meters, gauges, thermometers and similar units.
3. Pumps.

D. Install access panel markers with screws on equipment access panels.

3.02 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

B. All piping shall be labeled as directed by the owner or as designated on the drawings if the owner has no other preference.

C. Locate pipe markers where accessible and visible.

1. Pipes with OD, Including Insulation, Less Than 6”: Pretensioned pipe markers. Use size to ensure a tight fit.
2. Pipes with OD, Including Insulation, 6” and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

D. Locate pipe markers where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and locations as follows:

1. Near each valve and control device
2. Near each branch connection. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings and nonaccessible enclosures.
4. At access doors and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25’ along each run.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.03 VALVE TAGS

A. Install tags on valves and control devices in piping systems; valves within factory-fabricated equipment units; plumbing fixture supply stops; faucets; convenience and lawn-watering hose connections. List tagged valves in a valve schedule.

End of Section 21 05 53

SECTION 21 11 00 - PIPE AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the pipe and fittings as specified and indicated on the drawings.

1.02 QUALITY ASSURANCE

A. Welders Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing. Welders of steam and condensate return piping shall be holders of ASME 'R' and 'PP' or 'S' stamps.

B. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.

C. Soldering and Brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the valve specification is Victaulic and shall represent the minimum level of construction. Equipment manufactured by Anvil and Wheatland shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 ABOVE GRADE PIPING AND FITTINGS

A. Schedule 40 grade, ASTM A-53, black steel pipe shall be used for all Fire Protection Piping. Victaulic UL listed and FMG approved fittings and couplings shall be used for all joints and fittings. Schedule 10 black steel pipe shall be permitted in lieu of Schedule 40 steel pipe to meet N.F.P.A. 13 requirements, however joining methods will be strictly limited to Victaulic couplings and fittings. The use of threaded lightwall piping (Allied XL), and the use of lightwall materials, is strictly prohibited.

1. Rigid type couplings shall be fully installed at visual pad-to-pad offset contact. Tongue and recess couplings, or any couplings that require exact gapping of housings on each side of the coupling at specified torques, are not permitted.
   a. 1-1/4” through 4”: Factory assembled for direct stab installation without field disassembly. Victaulic Style 009 EZ.
   b. 5” through 8”: Victaulic FireLock™ Style 005.
   c. 10” and Larger: Victaulic Zero-Flex® Style 07.
2. Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications. Victaulic Style 75 and 77.

2.03 BELOW GRADE PIPE AND FITTINGS

A. ANSI Class 50 and 51 cement lined ductile iron pipe, or C900 plastic, with mechanical joints

shall be used for the fire protection service entrance line.

PART 3 EXECUTION

3.01 FIRE PROTECTION PIPING

A. Piping systems shall incorporate all necessary facilities for testing and draining the system. Provide auxiliary system drains for portions of the system that are trapped. System test drain shall be installed at an accessible location and shall discharge onto grade.

B. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs. Sprinkler Bulb protector must remain in place until the sprinkler is completely installed. Remove the bulb protector by hand after installation and before the system is placed in service. (Do not use any tools to remove the bulb protector.)

C. Underground service shall be installed per the requirements of NFPA Pamphlet 24.

D. Fire protection piping shall all be tested in accordance with NFPA and UBC requirements

E. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

3.02 EXPOSED AND CONCEALED PIPING

A. All piping shall be concealed in walls, below floors, or above ceilings unless indicated otherwise or shown running through areas with exposed structure. All pipe shall be installed parallel or perpendicular to building surfaces.

End of Section 21 11 00

SECTION 21 13 00 - WET SPRINKLER SYSTEM

PART 1 - GENERAL

1.01 SPRINKLER SYSTEM

A. Provide an automatic sprinkler system in the building as indicated on the drawings. Refer to section 21 11 00 for pipe and fitting.

B. The piping indicated on the plans are schematic in nature and are provided mainly for coordination purposes. The actual design and final head placement shall be determined by the fire protection engineer designing the system.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

B. The basis for the valve specification is Victaulic and shall represent the minimum level of construction. Equipment manufactured by Viking and Tyco shall be permitted to bid these specifications.

C. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 SPRINKLER COMPONENTS

A. Provide sprinkler system as indicated. System shall contain, but not be limited to, all piping, valves, test lines, drains and etc., as shown or required by NFPA-13 and NFPA-13R for a complete system.

B. Provide a freestanding type polished brass Fire Department connection, equal to Fire End and Croker No. 6510 or approved equal, 2-way clapper, 4" x (2) 2-1/2", where indicated on the Drawings, with hose threads complying with local Fire Department Standards. Installation shall include check valve and ball drip assembly, pipe to drain or discharge onto grade. Connection shall be labeled "Standpipe and Sprinkler".

C. Heads shall be Central Sprinkler or approved equal, as listed below. Equivalent sprinkler heads by Viking, Star, Grinnell or Reliable are acceptable for the heads specified. Head temperature ratings shall be 165°F unless otherwise specified. Sprinkler heads in elevator shafts and machine rooms shall be 212° F temperature activated.

1. Upright Sprinklers: Central Sprinkler Model GBQR upright automatic sprinkler, rough bronze finish
2. Upright Sprinklers with Shields: Central Sprinkler Model GBQR with WSG-2 Guard and Assembly, upright automatic sprinkler, rough bronze finish
3. Semi-Recessed Pendants: Central Sprinkler Model GBQR recessed automatic sprinkler, flat white finish, adjustable 2-piece escutcheon
4. Fully Recessed Sprinklers: Central Sprinkler Model GB4-FR (concealed) adjustable flush-concealed auto sprinkler, cover plate with flat white finish.
5. Side Wall Sprinklers: Central Sprinkler Model GB Sidewall, flat white finish

D. Sprinkler heads in areas with sheet rock ceilings shall be fully recessed head type.

E. Sprinkler heads in lay-in ceilings shall be located in the center of ceiling tiles with a tolerance of +/- 2 inches.

F. All control valves in the sprinkler system shall be provided with supervisory switches. Switches

will alarm when a valve is not in its normal operating position.

G. Provide water flow alarm apparatus for the system. Alarm device shall be a listed alarm check valve with all necessary attachments required to give an alarm. Flow alarm devices shall be installed per NFPA requirements.

H. Provide flow switches as indicated on the drawings and as required by NFPA.

I. At the Contractors option, sprinkler system final connections may be FlexHead Industries Inc. or approved equal, flexible piping connections. The flexible connection shall include a fully welded, braided and leak tested connector with a one-piece ceiling bracket, attachment hub and self-securing integrated ceiling grid mounting bracket. The flexible piping system shall be UL listed and FM approved suitable for their intended use.

PART 3 - EXECUTION

3.01 DESIGN AND INSTALLATION

A. Design and install a complete automatic sprinkler system for fire protection. All elements and components of the system shall be in compliance with NFPA Pamphlet 13 and 13R, "Standard for the Installation of Sprinkler Systems". Components shall be listed in current Underwriters Laboratories "Fire Protection Equipment List". Final acceptance shall be based on submission of test certificates, and completion of all regulatory body recommendations submitted following their final inspection.

B. Sprinkler head spacing, pipe sizing and flow calculations shall be hydraulically calculated. Design criteria shall be as follows:

1. For **Light Hazard**, provide a water density of 0.1 GPM per square foot over the most hydraulically remote 1500 square feet. Light hazard shall be installed in all areas of the building except mechanical rooms, storage rooms, and janitor’s closets or others required by NFPA 13.
2. For **Ordinary Hazard Group I**, provide a water density of 0.15 GPM per square foot over the most hydraulically remote 1500 square feet. Ordinary hazard, group I includes the following area types: mechanical rooms, storage rooms, janitors closets, restaurant Service areas (Kitchens), Automotive Show rooms/parking areas and as listed in NFPA 13.
3. For **Ordinary Hazard Group II**, provide a water density of 0.2 GPM per square foot over the most hydraulically remote 1500 square feet. Ordinary hazard, group II includes Mercantile, Library stack rooms up to 12’ in height, manufacturing areas, repair garages, machine shops and as listed in NFPA 13.
4. For **Extra Hazard Group I** provide a water density of 0.3 GPM per square foot over the most hydraulically remote 2500 square feet. Refer to NFPA for occupancy area requirements.
5. For **Extra Hazard Group II** provide a water density of 0.4 GPM per square foot over the most hydraulically remote 2500 square feet. Refer to NFPA for occupancy area requirements.
6. For **Residential Areas** per NFPA 13R and head manufacturers design requirements.

C. Size sprinkler piping by hydraulic calculations in accordance with NFPA Standard 13, Chapter 7. Hydraulic calculations shall include inside and outside hose requirements. Hose requirements shall be inserted at the locations in the system per NFPA. Pipe sizing shall provide an allowance of 10 psig in excess of base requirements. Head locations shall conform to the spacing shown on the Mechanical Drawings, Architectural Drawings, the Architectural Details, and elsewhere as required to provide a fully sprinklered building.

D. Orifice size, "K" factor, temperature rating, and model identification of installed heads shall be identical to system hydraulic calculation design data. Provide the final design and layout and hydraulic calculations required for the approval of the fire protection systems in accordance with requirements of the insurance interest having jurisdiction, state and local codes. Velocity pressure shall not be considered in the hydraulic calculations.

E. Submittals shall be provided showing detailed fire protection drawings and hydraulic calculations per NFPA-13 requirements including complete sprinkler system layout drawings with hydraulic calculation reference points and area of application indicated.

F. Sprinklers shall be shown on drawings and submittals and shall be specifically identified with the applicable style or series designation as published in the appropriate agency listing or approval. Trade names or other abbreviated designations are not permitted.

G. The systems shall be designed and installed by a licensed Sprinkler Contractor in full accordance with NFPA and all codes and standards. Shop drawings, layout and design shall be approved by the Local Authority Having Jurisdiction and the Engineer prior to installation.

End of Section 21 13 00

SECTION 22 01 00 - GENERAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, General Requirements (Division 1) and Section 26 01 13 - Electrical Connections, apply to the work specified in DIVISION 22 – PLUMBING

1.02 DESCRIPTION OF WORK

A. The plumbing contract includes all labor, materials and equipment required for the complete plumbing systems as shown and herein specified.

B. Provide all devices and accessories as necessary for complete and working systems.

C. The contractors shall become familiar with the work of all other trades and shall fully coordinate their work prior to ordering equipment or installation of systems.

1.03 QUALITY ASSURANCE

A. Each major component of equipment shall have the manufacturer's name; address, model number and rating on a nameplate securely affixed.

B. All equipment of one type (such as fixtures, pumps, valves, etc.) shall be the products of one manufacturer, unless otherwise specified.

C. In the event of discrepancies between the drawings and specifications, the contractor shall advise the engineer before proceeding with the work in order that correct progress is ensued.

D. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel." Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 SHOP DRAWINGS AND SUBMITTALS

A. Shop drawings shall be submitted as specified in Division 1. Product data shall be submitted for all materials and equipment specified in DIVISION 23

B. Shop drawings for equipment ‘Packages” shall be complete and include all items to be provided by a manufacturer’s representative or supply house. No partial submittals will be reviewed or approved without a complete and total equipment submittal.

C. Each shop drawing shall include a letter indicating all deviations from the drawings and/or specifications.

D. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:

1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
2. Capacity, pressure drop, RPM, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
3. Dimensional drawings showing layout, connection points, and detailed layout of components.
4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.
5. Conspicuously mark on each submittal the exact model, fittings, accessories, and devices to be supplied. When a schedule is shown on the drawings or in the specifications, provide a copy of that schedule with the shop drawing indicating the equipment

capacities and characteristics of the actual equipment being proposed.

6. Tags for equipment submitted shall match the tags indicated on the design drawings or specifications. Where equipment is noted on the drawings and not scheduled, refer to plan note and sheet number on the submittal.

E. Contractor shall check all shop drawings to verify that they meet the requirements of the drawings and specifications before forwarding to the architect and engineer. All shop drawings submitted shall bear the stamp of the contractor to show that they have been reviewed in detail.

F. No work shall be fabricated and no equipment ordered until the architect and engineer have returned acceptable reviewed shop drawings.

G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this section.

1.05 PROJECT SEQUENCING

A. The contractor shall refer to the architectural plans and specifications for areas of work and general schedules to determine the scope of work required during each phase of the construction.

B. All temporary valves, dampers, etc. not indicated, but required by phasing, shall be included in the base bid.

1.06 SUBSTITUTIONS

A. The materials, products, and equipment described in these specifications or on the drawings establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. Listing of these manufacturers shall in no way be construed as a device intended to limit the bidders to those specifically listed.

B. Reference to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number, shall be interpreted as having established a standard of quality and shall not be construed as limiting competition. Articles, fixtures, etc. of equal quality by manufacturers listed in this specification for the applicable use, shall be acceptable, subject to performance, spatial, structural, and electrical constraints of the project design.

C. The Engineer reserves last opinion as to a product's equality or superiority to that specified.

1.07 DEFINITIONS

A. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

B. Install: The term "install" is used to describe operations at the project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

C. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

D. Furnished by Owner or Furnished by Others: The item will be furnished by the Owner or Others. It is to be installed and connected under the requirements of this Division, complete and ready for operation, including all items incidental to the Work, including all services necessary for proper installation and operation. The Installation shall be included under the guarantee required by this Division.

E. The design engineer, referred to as "engineer" shall mean the engineering firm, HOSS & BROWN ENGINEERS, INC., Contact person: Brandon Frey.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Three (3) Flash Drives containing PDFs of Operation and Maintenance (O&M) Manuals shall be

submitted as described below. Files and folder names shall be clearly labeled. Folder structure and names shall be intuitive and clearly labeled.

B. Before project close-out, submit O&M operating, maintenance instructions, and parts lists for equipment provided. Include in the manual a list of emergency service organizations capable of rendering service for each piece of equipment. Include in the manual a set of as-built prints.

C. Keep in a safe place all keys, wrenches, and other specialty tools furnished with equipment. Present to owner at project close-out and receive a receipt showing he has received the same.

D. At the completion of the project furnish to the Architect for the Owner O&M brochures divided and tabbed, containing all data, diagrams, as-built plans, capacities, spare part numbers, manufacturers service and maintenance data, warranties, guarantees, etc., including local contacts and escalation schedule complete with addresses and telephone numbers, of all equipment, apparatus, and system components furnished and installed under this Division of the specifications.

1.09 CODES AND ORDINANCES

A. All work shall be in accordance with applicable codes, rules, ordinances, and regulations of local, state, and federal governments and other authorities having jurisdiction.

B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard, to any ordinances, laws, codes, rules, or regulations bearing on work, the contractor shall execute work in accordance with such without increased cost to the owner, but not until he has referred such variances to the engineer.

C. The contractors shall secure and pay for the necessary permits and certificates of inspection for their trade. Keep record of all permits and inspections and submit two copies to the engineer with request for final inspection.

1.10 OWNER TRAINING

A. Contractor shall demonstrate to the owner that all systems installed under this division of the specifications are complete and operating as intended.

B. Any adjustments or other additional work required as a result of failure of any system to comply with the intent of this specification shall be accomplished at no additional cost to the Owner.

1.11 WARRANTY

A. This contractor shall warrant that the complete systems installed under this contract shall be free of defects in workmanship and materials for a period of one (1) year from the date of substantial completion by the arch/owner.

B. If defects occur during the one year guarantee period, this contractor shall repair or replace such defects at no expense to the owner and to the satisfaction of the owner and engineer.

PART 2 PRODUCTS

2.01 GENERAL

A. Where the quality of required material is not specified, the Contractor shall furnish a first class standard item as approved by the Architect/Engineer.

B. Capacities of equipment and materials shall not be less than those indicated.

C. All work performed shall provide a neat and workmanlike appearance when completed, to the satisfaction of the engineer.

D. Provide 3 ½” concrete base for all floor mounted equipment unless shown or noted otherwise. Provide 6x6 welded wire fabric reinforcing minimum or as required by the structural engineer.

E. Adequately protect equipment from damage after delivery to the jobsite. Cover with heavy polyethylene plastic. Elevate equipment when there is danger of water damage. Equipment damaged will be rejected.

F. Any scratches to factory finishes shall be touched up using factory supplied paint before final acceptance. If extensive damage to factory finishes has occurred, equipment panels shall be replaced to the satisfaction of the engineer. If rust has formed, remove as recommended by the manufacturer prior to touch-up.

2.02 EQUAL PRODUCTS OF LISTED MANUFACTURERS

A. In general, the specifications and drawings identify required materials and equipment by naming first the manufacturer whose product was used for the basis of design. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality, construction and dimensional requirements for comparing the other manufacturer's products. The capacity and performance of all equipment shall meet or exceed what is indicated on the drawings and/or scheduled.

B. Where other manufacturer's names are listed, they are considered an acceptable manufacturer for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers have been shown.

C. Where other than first named products are used, it shall be the responsibility of the contractor to determine prior to bid time that his proposed materials and equipment selections do not require adjustments in the mechanical, electrical , structural, or architectural requirements as shown on the drawings. The contractor shall include in his bid all costs associated with any required adjustments.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all equipment in strict accordance with the manufacturer's recommendations and the shop drawings reviewed by the Engineer.

B. The complete installation shall function as designed and intended with respect to efficiency, capacity, and noise level, etc. Any abnormal noise caused by rattling equipment, piping, ducts, conduit, air devices, or squeaks in rotating equipment will not be acceptable

C. Locations of equipment, piping, and other work are indicated diagrammatically on the drawings. Each contractor shall coordinate exact locations subject to structural conditions, work of other contractors, access requirements, and the approval of the architect and engineer.

D. Any item interfering with proper placement of other work shall be removed and relocated without extra cost if reasonable coordination would have eliminated the interference. Damage to other work caused by this contractor shall be restored as specified for new work.

E. Written dimensions are preferred over scaled dimensions. When written dimensions are not available, the contractor shall be responsible for determining the proper installed location.

F. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification.

G. Contractor shall perform initial start-up of systems and shall provide necessary supervision and labor to make the first seasonal change-over of systems requiring same. Owner's operating personnel shall be present during this operation.

H. It is the contractor's responsibility to provide materials and trim which properly fit the types of

ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.

I. This contractor shall provide all miscellaneous steel, etc., for the proper installation of the systems specified and/or indicated on the plans.

3.02 CONNECTIONS TO BUILDING STRUCTURE

A. Any item connecting to building structure shall be done in a manner accepted by the structural engineer.

B. When bar joists are used for steel construction, items shall be supported from angle iron spanning the top chord of the joists.

3.03 CLEANING

A. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.

3.04 VISIT TO THE SITE

A. Before submitting his bid, the Contractor shall visit the location of the job and shall fully understand the scope of the work to be done and the conditions under which it is to be performed. In no case shall additional compensation be granted when existing conditions could reasonably be determined.

3.05 EXISTING UTILITIES

A. Locate and mark all known utilities prior to proceeding with work. Proceed with caution since unmarked utilities may exist on site.

B. Should any existing utilities be damaged or disrupted, immediately notify Owner and repair to existing conditions.

C. The Contractor shall closely coordinate all utility downtime with the Owner and Architect giving a minimum fourteen (14) day notice prior to downtime.

D. Downtimes are to be held to a minimum duration with the Owner being notified as to the extent of said downtime.

End of Section 22 01 00

SECTION 22 05 13 - ELECTRICAL PROVISIONS OF PLUMBING WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The contractors responsible for Division 22 work shall coordinate with the Electrical Contractor to insure electrical and controls of the proper size are furnished. Further, the Plumbing Contractor shall furnish all electric control items indicated to the Electrical Contractor for installation and connection, unless noted otherwise.

B. Refer to Section 26 01 13 - ELECTRICAL CONNECTIONS for required electrical connections.

PART 2 PRODUCTS

2.01 MOTOR STARTERS

A. The Electrical Contractor shall provide all motor starters required for equipment provided in the mechanical contract that is not integral with equipment.

PART 3 EXECUTION

3.01 MOTOR STARTERS

A. The Plumbing Contractor shall coordinate all motor starters type and size with the Electrical Contractor to insure compatibility with the motors provided in this contract.

ITEM	Furnished By	Set By	Power Wiring	Control Wiring
Pumps	PC	PC	EC	EC
Loose motor starters, disconnect switches, thermal overloads and heaters.	EC	EC	EC	EC
Aquastats	PC	PC	EC	EC

PC = Plumbing Contractor
EC = Electrical Contractor

End of Section 22 05 13

SECTION 22 05 14 - SERVICES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the services as shown on plans and specified.

1.02 UTILITY FEES

A. The Contractor shall pay any and all required utility service fees associated with this project.

1.03 UTILITY CONNECTION COORDINATION

A. This Contractor shall provide all service piping and accessories required to complete connection and not furnished by the serving utility. It is the responsibility of this Contractor to coordinate with the serving utility company regarding the items furnished, the work performed, inspections required, and any associated permits.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 SERVICES

A. This Contractor shall terminate gas, water, storm, and sewer lines at a point approximately five feet from the building wall or as shown on the drawings. This Contractor shall make connection to the various services provided by others; coordinate all connection requirements with civil engineer. Installation of utility connections shall be in complete conformance with all regulations having jurisdiction, and the requirements of each serving utility.

End of Section 22 05 14

SECTION 22 05 15 - PLUMBING RELATED WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The following is the work required by the General Contractor to facilitate the work of the Mechanical Contractor.

1. Openings and chases.

B. The following is the work required by the Mechanical Contractor to facilitate the work of his Contract.

1. Cutting and patching.
2. Excavation and backfilling.
3. Pipe sleeves.

1.02 RELATED DOCUMENTS

A. Refer to Division 2 for backfilling requirements.

B. Unless otherwise addressed in the specification, as a minimum, backfill in 6” lifts, compacting to a minimum of 90%. The first 12” of fill above any buried item outside the building shall be sand in order to contrast with other fill material. Provide a yellow warning tape at the top of the sand layer.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 GENERAL CONTRACTOR'S WORK

A. The General Contractor shall leave such openings and chases in new construction for pipes, cabinets, access doors, and equipment as may be necessary or directed by the Architect to facilitate the work of the Plumbing Contractor and to refinish around same. The Plumbing Contractor shall properly advise in due time as to the location and sizes of such openings and chases.

3.02 MECHANICAL CONTRACTOR'S WORK

A. The Mechanical Contractor shall be responsible for locating and setting his own pipe sleeves, and be well aware of the job progress to avoid unnecessary delay for setting of same.

B. The Mechanical Contractor shall be responsible for cutting his own holes in existing construction and for patching and finishing around same, unless noted otherwise, to the satisfaction of the Architect. Any holes left in walls when existing pipe is removed by this Contractor shall be patched and finished by this Contractor.

C. The Mechanical Contractor shall do all excavating and backfilling necessary to complete work under this contract. Lines shall be used to lay out the trenches for underground work. Trenches shall be of sufficient width and shall be cribbed or braced to prevent cave-in or settlement. Trenches close to walls and columns of the building shall not be excavated without the Architect's prior consent. The bottoms of trenches shall be tamped hard and graded to secure the required fall before laying pipe. Bell holes shall be excavated so the pipe will rest on solid ground for its entire length.

D. Hand backfill and tamp backfill into place at sides of pipes, leaving tops and joints exposed until pipe runs have been tested and approved.

E. All sidewalks, streets, or alley surfaces that have to be broken in connection with this contract shall be patched to the satisfaction of the Architect.

End of Section 22 05 15

SECTION 22 05 16 - EXPANSION COMPENSATORS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide expansion compensators as specified and as indicated on the drawings.

B. Provide flexible pipe expansion compensators with guides as per manufacturer's recommendations. Bellows-type and slip type compensators are not acceptable.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the specification is Metraflex and shall represent the minimum level of construction. Products manufactured by Flexicraft, US Bellows, Mason Industries, and Hunter shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 EXPANSION JOINTS

A. Provide Metraflex, "Metraloops", or approved equal, flexible loop type compensators constructed of two flexible sections of hose and braid, two 90° elbows and one 180° return bend.

B. Expansion compensators shall impart minimal thrust loads to anchors and shall be installed in a neutral, pre-compressed or pre-extended condition as required by installation temperatures.

C. Compensators shall be guided to direct movement into the Metraloop or approved equal. One guide will be required within four pipe diameters on either side of the compensator.

D. The compensator shall be supported at the 180° turn bend installed in the horizontal plane. No support is required if installed in the vertical plane.

E. The compensators in copper lines shall be bronze hose and braid with copper sweat ends:

LINES	SERIES
1/2" to 4"	MLS or approved equal, rated for 4" movement (MLG may be substituted for larger lines)

PART 3 EXECUTION

3.01 INSTALLATION

A. Each compensator shall be installed in strict compliance with manufacturer's recommendations.

End of Section 22 05 16

SECTION 22 05 17 - FIRESTOPPING FOR PLUMBING SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested firestop systems shall be used in specific locations as follows:

1. Penetrations for the passage of piping and other Plumbing equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
2. Repetitive plumbing penetrations in fire-rated floor assemblies. Penetrations for the installation of tubs, showers, aerators and other plumbing fixtures.

1.04 REFERENCES

A. Test Requirements: ASTM E-814-02, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 (August 24, 2000) and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. The UL Fire Resistance Directory includes the following:

1. Firestop Devices (XHJI)
2. Fire Resistance Ratings (BXUV)
3. Through-Penetration Firestop Systems (XHEZ)
4. Fill, Voids, or Cavity Material (XHHW)
5. Forming Materials (XHKU)

C. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

D. Inspection Requirements: ASTM E 2174 – 01, “Standard Practice for On-site Inspection of Installed Fire Stops.”

E. ASTM E-84-01, “Standard Test Method for Surface Burning Characteristics of Building Materials.”

F. All major building codes: ICBO, SBCCI, BOCA, and IBC.

G. NFPA 101 - Life Safety Code

1.05 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop system installation must meet requirements of ASTM E-814 or UL 1479 tested

assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.

1.06 SUBMITTALS

A. Submit Product Data: Manufacturer’s specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's UL approved installation instructions.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.07 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its firestopping products to the Contractor or to an Installer engauged by the Contractor does not in itself confer qualification on the buyer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.09 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Scheduling

1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions

before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, Phone 800-879-8000
2. STI Firestop
3. 3M Fire Barrier Products.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 FIRESTOPPING, GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device or approved equal: Add Aerator adaptor when used in conjunction with aerator (“sovent”) system.
2. Hilti CP 681 Tub Box Kit or approved equal, for use with tub installations.

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe and copper pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant or approved equal
2. Hilti CP 604 Self-leveling Firestop Sealant or approved equal
3. Hilti CP 620 Fire Foam or approved equal
4. Hilti CP 606 Flexible Firestop Sealant or approved equal
5. Hilti CP 601s Elastomeric Firestop Sealant or approved equal

D. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, and plastic pipe the following

products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant or approved equal

E. Firestop collar or wrap devices attached to assembly around combustible plastic pipe, the following products are acceptable:

1. Hilti CP 642 Firestop Collar or approved equal
2. Hilti CP 643 Firestop Collar or approved equal
3. Hilti CP 645 Wrap Strips or approved equal

F. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

PART 3 EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
2. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROLS

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating

of existing firestop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

End of Section 22 05 17

SECTION 22 05 19 - METERS AND GAUGES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide gauges and thermometers as specified.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Provide devices by one of the following manufacturers.

1. Marshalltown
2. Trerice
3. Weiss Instruments
4. Weksler Instruments
5. Miljoco
6. US Gauge
7. Crosby

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 THERMOMETERS

A. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

B. Scale range: Temperature ranges for services listed as follows:

1. Domestic Hot Water: 30 to 240 deg with 2-degree scale divisions (0 to 115 deg C with 1-degree scale divisions).
2. Domestic Cold Water: 0 to 100 deg F with 2-degree scale divisions (minus 18 to 38 deg C with 1-degree scale divisions).

C. Thermometers

1. Provide adjustable, red reading tube thermometer where shown.

2.03 PRESSURE GAUGES

A. Dial type with enameled steel or cast aluminum case, white dial, case relief vent, recalibration device and AISI 316 stainless steel Bourdon tube, tip and socket.

B. Gauges shall be installed with brass pipe fittings, unions, gauge cock, and pulsation dampers.

C. Unless indicated otherwise, ranges on gauges shall be as follows:

1. 0-160 PSI - Water service entrance
2. 0-100 PSI - Domestic water system

PART 3 EXECUTION

3.01 THERMOMETERS INSTALLATION

A. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.

B. Install in the following locations, and elsewhere as indicated:

1. At outlet of each water heater.

3.02 INSTALLATION OF PRESSURE GAUGES

A. Install in the following locations, and elsewhere as indicated:

1. At building water service entrance.
2. At inlet and discharge of pressure reducing stations.

End of Section 22 05 19

SECTION 22 05 23 - PIPING SPECIALTIES AND VALVES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Valves shall be installed at locations shown and specified; the locations shall be accessible. All valves shall be installed with their stems or spindles horizontal or above.

B. Provide unions or grooved mechanical couplings where shown at all equipment connections and at other points where disconnection of piping will be required.

C. Strainers shall be provided at locations shown.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the valve specification is Nibco and MEPCO and shall represent the minimum level of construction. Equipment manufactured by NVent, Apollo, Milwaukee, Wheatley, and Victaulic shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 VALVES

A. Bronze or brass ball valves rated at 150 PSI SWP and 600 PSI WOG, shall have two or three piece stainless steel, cast bronze, or brass bodies with TFE seats, stainless steel full port ball, separate packing nut with adjustable stem packing, and anti-blowout stem. Valves ends shall have full depth ANSI, Vic-Press™ or approved equal, or extended solder connections, and manufactured to comply with MSS-SP 110, shall be used in 3" and smaller copper and steel lines for domestic water duties. NVent PL-200, Victaulic Series 569, NIBCO T585-70-66, Jomar T/S 100-SS-n or approved equal, in uninsulated applications and NIBCO T585-70-66-EL or approved equal, in insulated lines. Victaulic Series 726 or approved equal, when using grooved end valves.

B. Butterfly valves rated 300 PSI working pressure, grooved end or lug style, ductile iron body with 2” extended neck for insulation, and 10 position lever shall be used in 4" and larger copper and steel lines for all domestic water duties. Valves to have electrode-less nickel coated ductile iron or aluminum bronze disc with pressure responsive EPDM synthetic rubber seat, 400 series stainless steel stem and shall not have exposed stem to disc fasteners. (Stem shall be offset from the disc centerline to provide full 360-degree circumferential seating.) Valves to be rated at full pressure rating for dead end bi-directional service. Valves to be manufactured in compliance with MSS-SP 67. Provide with isolating flanges when used in copper lines. NIBCO LD2000-3 (4” thru 6”) or approved equal, NIBCO LD 2000-5 (8” thru 12”) or approved equal, and Victaulic Vic-300 MasterSeal™ or approved equal, when using grooved end valves through 12”. Victaulic Series W706 or approved equal, shall be used for grooved end piping systems 14” through 24”. Jomar 600 series or approved equal, for lug type and Jomar 900 series for wafer type.

C. Y-pattern swing-type check valve manufactured in accordance with MSS-SP 80, Class 150 PSI B62 cast bronze body shall be used in 2 1/2" and smaller lines for domestic water duties. NIBCO T-433Y, Jomar T/S 511 or approved equal. Victaulic Series 712 or approved equal, when using grooved end valves.

D. Swing-type check valve manufactured in accordance with with MSS-SP 71, class 125, grooved ASTM A536 ductile iron or flanged ASTM A126 class B cast iron body with bronze trim or

wafer-style with stainless steel spring, bronze disc plates, rubber seat and cast iron body, shall be used in 3" and larger lines for domestic water duties. NIBCO T-433Y, Jomar T/S 501 or approved equal. For vertical line applications use NIBCO T-480 or approved equal. When using grooved end valves, Victaulic Series 712 or approved equal, swing check valve for horizontal installations, Victaulic Series 716, Victaulic Series W715 or approved equal, for vertical or horizontal installations.

E. Victaulic / TA Hydronics Series 787 or 786, MEPCO model MBVT, or engineer approved equal NIBCO T or S-1710, bronze body, globe style manual valve with flow measuring taps shall be used for all balancing valves 2" and smaller for domestic water duties.

F. Victaulic / TA Hydronics Series 789 or 788,MEPCO model MBVF, or engineer approved equal NIBCO F or G-737, cast iron body, wye patterned globe style manual valve with flow measuring taps shall be used for all balancing valves 2 ½" and larger for domestic water duties.

G. Nibco, or engineer approved equal, bronze or brassball valves rated at 150 PSI SWP and 600 PSI WOG, shall have two piece cast bronze or brass bodies with TFE seats, stainless steel full port ball, separate packing nut with adjustable stem packing, and anti-blowout stem. Valves with threaded ends, shall be used in 3" and smaller steel lines for all natural gas duty. Valve to be NIBCO T585-70-UL, Jomar T100NE, or approved equal, with U.L. listing and CSA listing

2.03 UNIONS

A. Screwed or solder type ground joint unions shall be used on piping 2" and smaller. Flanged connections shall be used on pipe 2½" and larger.

B. Unions are not required in installations using Victaulic grooved plumbing couplings.

C. Unions shall not be installed in walls or partitions or above non-accessible ceilings.

D. Pressure ratings on unions shall be equal to or greater than the lines they are in.

E. Dielectric unions or Victaulic Style 47 dielectric waterway fittings shall be used where copper lines connect to other types of materials.

2.04 ESCUTCHEONS

A. Provide nickel-brass or chrome plated escutcheons on exposed pipes where they pass through walls, ceilings, and base cabinet penetrations.

2.05 STRAINERS

A. Provide Victaulic, Watts, Dunham, Wheatley, or engineer approved equal, strainers where shown with pressure ratings equal to or greater than line operating pressure.

B. Provide ball valves in blowoff tapping of all strainers.

C. Strainers screens shall be stainless steel with 1/8” perforations for water service.

PART 3 EXECUTION

End of Section 22 05 23

SECTION 22 05 29 - PIPING SUPPORTS, ANCHORS AND SEALS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide piping support, anchors, and seals as specified and indicated on drawings.

B. Pipe shall not pass through footings or beams without the consent of the Architect.

1.02 SUBMITTALS

A. Shop drawings of the fire-stopping method shall be approved prior to the setting of any sleeves and shall clearly define the UL fire-stopping method and required sleeve clearances.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for pipe hangers is B-Line Systems Inc. and shall represent the minimum level of construction. Equipment manufactured by Erico and Grinnell shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 HANGERS AND SLEEVES

A. All insulated horizontal piping shall be supported from outside the insulation. Provide inserts and saddles as recommended by the insulation manufacturer.

B. Pipe hangers for lines 1/2” to 2” shall be adjustable swivel ring hanger equal to B-Line Figure B-3170NF and B-3170CT or approved equal, for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger swivel rings. Upper ends supported as hereinafter specified with the proper B-Line or approved equal, upper attachments.

C. Pipe hangers for lines 2 1/2” to 4” shall be light duty clevis hanger equal to B-Line Figure B-3104 and B-3104CT or approved equal, for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger rod holes. Upper ends supported as hereinafter specified with the proper B-Line or approved equal, upper attachments.

D. Pipe hangers for lines 6” and larger shall be standard clevis hanger equal to B-Line figure B3100 and B3100C or approved equal, for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger rod holes. Upper ends supported as hereinafter specified with the proper B-Line or approved equal, upper attachments.

E. Provide B-Line Figure B-3373 and B-3373CT or approved equal, riser clamps for ferrous and copper piping, respectively, at each floor and at other locations where vertical support is necessary.

F. Pipe sleeves will be required in all pipe and duct penetrations through new exterior walls, masonry walls, floors and fire rated gyp. board walls. Sleeves shall be either Schedule 5 steel pipe, field fabricated from minimum 16 gauge steel with 2" overlap at the seam, or as required by U.L. listed fire-stopping system.

G. Pipe sleeves will not be required in existing wall penetrations of masonry construction when such openings are made by "core-drilling".

PART 3 EXECUTION

3.01 PIPE SLEEVES

A. Space between sleeves and pipes in outside walls shall be filled or tightly caulked with oakum, butyl rubber, link seals or other approved equally effective material to resist the penetration of water. Pipe sleeve shall be sufficient diameter to provide approximately 1/2" clearance around pipe, and in the case of insulated pipe, approximately 1/2" around insulation.

B. Space between sleeves and pipes in other wall construction shall be diameter as required to provide the clearance required by the U.L. listed fire-stopping method chosen by the Contractor.

C. Sleeves shall be set no closer than three pipe diameters center to center, be set 3/4" past all wall surfaces, and securely anchored to the wall.

3.02 PIPE HANGERS

A. Upper ends of hanger rods shall be supported angle iron laid across top chord of bar joists, or from side beam clamps in steel structure.

B. Upper ends of hanger rods in other construction types shall be as recommended by the Structural Engineer of record.

C. Hanger and support spacing for horizontal steel and copper piping shall not exceed the values given in the following table:

NOMINAL PIPE SIZE	STEEL PIPE	COPPER PIPE
1/2" - 1-1/4"	7'	5'
1-1/2" - 2"	9'	6'
2-1/2" - 3"	11'	10'
4"	14'	10'
6"	17'	--
8"	19'	--
10" - 12"	22'	--

D. Soil, waste, vent and drain pipe as well as roof drain lines shall have a minimum of one hanger per pipe section at the joints and at changes in direction and branch connections. If FM approved couplings are used, pipe may be hung with one hanger per 10 foot lengths and at every third fitting where they are contiguous in conformance with manufactures installation instructions.

E. No pipe hanger rod shall be less than 6" in length unless otherwise shown or approved.

F. Spacing of supports and braces for exposed vertical piping shall not exceed the hanger spacing specified for horizontal pipe, unless otherwise indicated.

3.03 FLASHINGS

A. All vent pipes passing through the roof shall be flashed by the roofing contractor.

End of Section 22 05 29

SECTION 22 05 48 - VIBRATION ISOLATORS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide vibration isolators where shown and as specified.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for vibration isolators in this specification is Amber/Booth and shall represent the minimum level of construction. Equipment manufactured by Korfund, Vibration Eliminator, and Mason shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 ISOLATION HANGERS

A. Hang the following on type BRD rubber in shear hangers, properly sized for unit weight, rated for 0.50 inch deflection as manufactured by Amber/Booth Company, or equal.

PART 3 EXECUTION

End of Section 22 05 48

SECTION 22 05 50 – TESTING AND ADJUSTING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide testing and adjusting of the systems as specified and indicated on drawings.

B. Systems shall be fully tested, before covering or concealing, in the presence of the Owner's representative.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 PIPING SYSTEMS, INTEGRITY TEST

A. The following piping systems shall be fully tested before covering and concealing in the presence of the Owner's representative. All leaks shall be repaired in a satisfactory manner.

1. Domestic water piping interior lines shall be tested in accordance with the IPC/UPC as follows:
   a. Hydrostatically tested at 100 PSI (or system pressure) for a period of 1 hour with no drop in water pressure.
   b. Air tested at minimum 50 PSI for 20 minutes with no loss of pressure.
2. Compressed air piping shall be tested at 150% of operating pressure but not less than 50 PSI for a period of 1 hour.
3. Purified water piping shall be tested at 150% of operating pressure but not less that 100 PSI for a period of 1 hour.
4. All fittings and joints in gas piping shall be soap tested while holding a 50- PSI air pressure.

B. Soil, waste, vent and roof drain pipe underground shall be tested before complete covering. This test shall be made by extending a 10' length of pipe vertically, temporarily caulking, and filling with water. This test shall remain 12 hours.

C. Soil, waste, vent and roof drain pipe in the building shall be tested in accordance with IPC/UPC as follows:

1. Minimum hydrostatic pressure of 10 feet of water for a period of 1 hour with no drop in water level. System shall be visually inspected after the 1 hour duration for leaks
2. Air tested at minimum 5 PSI for 20 minutes with no loss of pressure.

3.02 OTHER REQUIREMENTS

A. All flush valves, faucets and other plumbing items shall be properly adjusted.

B. All hot water recirulating valves shall be balanced to the flows noted on the drawings using gauges supplied by the valve manufacturer.

C. Domestic water piping system shall be purged of deleterious matter and disinfected prior to utilization per IPC as follows:

1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlets.
2. The system, or part thereof, shall be filled with a water/chlorine solution containing at least 50 ppm 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 200 ppm 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.

End of Section 22 05 50

SECTION 22 05 53 - PLUMBING IDENTIFICATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide HVAC identification as specified and indicated on the drawings.

B. This Section includes the following mechanical identification materials and their installation:

1. Equipment markers
2. Access panel and door markers
3. Pipe markers
4. Valve tags
5. Valve schedules

1.02 SUBMITTALS

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

B. Valve Schedules: Provide valve numbering scheme and identification type for each piping system. Furnish extra copies (in addition to mounted copies) to include in Operation and Maintenance Manuals.

1.03 COORDINATION

A. Coordinate installation of identifying devices with completion of insulation and jacketing surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:

1. Seton
2. Brady
3. Craftmark
4. Brimar Industries, Inc.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Markers: Engraved, color-coded laminated plastic.

1. Terminology: Match schedules as closely as possible.
2. Data:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
3. Size: 2-1/2” by 4” for control devices, dampers, and valves; 4-1/2” by 6” for equipment.
4. Letter Size: Minimum 1/4 “ for name of units if viewing distance is less than 24 inches, 1/2“ for viewing distances up to 72 inches and proportionately larger lettering for greater

viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

B. Access Panel and Door Markers: 1/16" thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8" holes for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.03 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ANSI/ASME A13.1, unless otherwise indicated.
2. Type and Size of Letters: Comply with ANSI/ASME A13.1, unless otherwise indicated.
3. Legends: Spelled out in full or commonly used and accepted abbreviations.
4. Pipes with OD, Including Insulation, Less Than 6": Full-band pipe markers extending 360 degrees around pipe at each location.
5. Pipes with OD, Including Insulation, 6" and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
6. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semi rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semi rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

2.04 VALVE TAGS

A. Valve Tags: Stamped or engraved with ¼" letters for piping system abbreviation and ½" numbers, with numbering scheme to match existing numbering scheme on temperature control drawings. Provide 5/32" hole for fastener.

1. Material: 3/32" thick laminated plastic with 2 black surfaces and white inner layer.
2. Valve-Tag Fasteners: Brass beaded wire-link chain, beaded chain or S-hook.
3. Valve tag size and shape: 1 ½" round.

2.05 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on temperature control drawings), location of valve (room or space), normal-operating position (open, closed, or modulating) and variations for identification. Mark valves for emergency shutoff and similar special uses.

B. Valve-Schedule Frames: Glazed display frame for removable mounting on walls for each page of valve schedule. Include mounting screws.

C. Frame: Extruded aluminum.

D. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.06 EQUIPMENT LOCATORS ON CEILING

A. Provide ¼" round colored dot stickers (as available at office supply stores) on ceiling grid for locating equipment and valves. Adhere stickers to the ceiling grid as close to each piece of equipment as possible. Colors shall be as follows.

1. Zone/Isolation water valves Black

B. Approval shall be obtained from Architect prior to applying dots.

PART 3 EXECUTION

3.01 EQUIPMENT IDENTIFICATION

A. Install equipment markers on or near each piece of plumbing equipment.

B. All equipment shall be labeled as directed by the owner or as designated on the drawings if the owner has no other preference.

C. Locate equipment markers where accessible and visible. Include markers for the following general categories of equipment:

1. Main control and operating valves including safety devices.
2. Meters, gauges, thermometers and similar units.
3. Pumps.
4. Water Heaters.
5. Strainers, filters, water-treatment systems and similar equipment.

D. Install access panel markers with screws on equipment access panels.

3.02 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

B. All piping shall be labeled as directed by the owner or as designated on the drawings if the owner has no other preference.

C. Locate pipe markers where accessible and visible.

1. Pipes with OD, Including Insulation, Less Than 6”: Pretensioned pipe markers. Use size to ensure a tight fit.
2. Pipes with OD, Including Insulation, 6” and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

D. Locate pipe markers where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and locations as follows:

1. Near each valve and control device
2. Near each branch connection. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings and nonaccessible enclosures.
4. At access doors and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25’ along each run.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.03 VALVE TAGS

A. Install tags on valves and control devices in piping systems; valves within factory-fabricated equipment units; plumbing fixture supply stops; faucets; convenience and lawn-watering hose connections. List tagged valves in a valve schedule.

End of Section 22 05 53

SECTION 22 07 16 - PLUMBING INSULATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct installation of insulation on all piping, fittings, valves, controls and all other items connected into the system as defined in the specifications and on the drawings.

B. All materials specified in this section shall meet UL 723, ASTM E84, and NFPA 255: maximum flame spread index of 25 and maximum smoke developed index of 50.

C. Refer to Part 3 for requirements for insulation thickness and instruction on where insulating materials shall be applied.

1.02 WORKMANSHIP

A. Insulation shall be installed by a licensed contractor and applied in accordance with the manufacturer's instructions and recommendations.

1. All work shall comply with all applicable federal, state and local codes and laws. This shall include, but shall not be limited to, the Occupational Safety and Health Act.
2. All work shall conform to accepted industry and trade standards for commercial and industrial insulations.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for plumbing insulation in this specification are as listed below and shall represent the minimum level of construction. Equipment manufactured by Johns-Mansville, Owens-Corning, Knauf, Armacell, Aeroflex, Aerofoam USA, and Truebro shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 FIBER GLASS PIPE INSULATION

A. Johns-Manville Micro-Lok or approved equal, preformed fiber glass pipe insulation, complying with ASTM C 547, Type 1, rigid molded pipe insulation, noncombustible. Factory-applied ASJ vapor retarder jacket: a white, kraft paper, reinforced with a glass fiber yarn and bonded to an aluminum foil, complying with ASTM C1136 Type I, with self-sealing longitudinal closure laps and butt strips. Adhesive materials and tapes shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Thermal Conductivity (k-Value): 0.23 at 75°F mean temperature
2. Water vapor transmission: 0.02 perms max
3. Maximum Service Temperature: 850°F

B. All fittings, valves, tees, flanges, connections, etc. shall be insulated and covered with the appropriate PVC insulated fitting covers. Fitting covers shall match PVC Jackets, refer to specification below.

C. The basis for fiber glass pipe insulation and fitting covers is Johns-Manville which shall represent the minimum level of construction. Products manufactured by Owens-Corning and Knauf shall be

permitted to bid these specifications.

2.03 FLEXIBLE ELASTOMERIC PIPE INSULATION

A. Armacell AP/Armaflex SS or approved equal, fiber-free elastomeric foam insulation with self-sealing seams. Comply with ASTM C534, Type I, ASTM C1338 fungi resistance and ASTM G22 bacterial resistance. Adhesive materials and tapes shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Density: 3.0 – 6.0 pcf
2. Thermal Conductivity (k-Value): 0.25 at 75°F mean temperature
3. Water vapor permeability: 0.05 perm-in
4. Maximum Service Temperature: 180°F (continuous exposure)

B. All fittings, valves, tees, flanges, connections, etc. shall be insulated and covered with the Armacell factory-fabricated insulation fittings. Provide Armafix or approved equal, pre-insulated pipe hanger fittings at all hanger locations.

C. The basis for flexible elastomeric insulation is Armacell which shall represent the minimum level of construction. Products manufactured by Aeroflex and Aerofoam USA shall be permitted to bid these specifications

2.04 LAVATORY PIPING COVERS

A. Handicapped lavatory sink P-traps and hot and cold water lines shall be insulated with Truebro Lav Guard 2 or approved equal, fully molded vinyl insulation system. Color shall be china white and paintable with latex paint.

1. Thickness: 0.125 inches
2. ADA Compliant
3. Burning Characters: Meets ASTM D-635
4. Bacteria/Fungus Resistance: Meets ASTN G21 and G22, result: 0 growth

2.05 PVC JACKETS

A. High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C, 30 mils thick, white paintable finish, roll stock ready for shop or field cutting and forming. Provide factory fabricated fitting covers of same material, finish, and thickness as jacket. Adhesive materials and tapes shall be compatible with insulation materials, jackets, and substrates and for bonding jacket to itself and to insulation.

2.06 ALUMINUM JACKETS

A. Aluminum 0.016" thick sheet complying with ASTM B 209, embossed finish, with longitudinal slip joints and 2" laps, die-shaped fitting covers with factory-attached protective liner. Adhesive materials and tapes shall be compatible with insulation materials, jackets, and substrates and for bonding jacket to itself and to insulation.

2.07 INSULATED PIPE SUPPORTS

A. 360° pre-molded insulated pipe supports providing a continuous section of insulation with vapor barrier and galvanized steel shield. The insulation and vapor barrier shall extend beyond the shield for vapor tight joint with the adjoining insulation. Insulation shall be water-repellent treated calcium silicate meeting the requirements of ASTM C533 with vapor barrier jacket.

1. Minimum Compressive Strength:
   a. 100 PSIG for pipe sizes smaller than 6”
   b. 450 PSIG for pipe sizes 6” and larger

2.08 INSULATION SHIELDS

A. 180°, 20 gauge, galvanized metal shields pre-formed to fit the insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry and ducts are tightly sealed at all joints and seams.

3.02 COMMON INSULATION INSTALLATION REQUIREMENTS

A. Unless otherwise indicated, all insulation shall be installed in accordance with the "Commercial & Industrial Insulation Standards", published by the Midwest Insulation Contractors Association.

B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of pipes and fittings.

C. Keep insulation materials dry during application and finishing.

D. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

E. Install insulation with least number of joints practical.

F. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic and/or tape. Install insulation continuously through hangers and attachments.

G. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate.

H. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Coordinate requirements in first two paragraphs and associated subparagraphs below with Division 7 Section "Joint Sealants."
2. Seal penetrations with flashing sealant.
3. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
4. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
5. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (that are not fire rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Coordinate insulation installation with the fire stopping material manufacturer's UL approved installation instructions.

E. Insulation Installation at Floor Penetrations: Install insulation continuously through floor penetrations that are not fire rated. Coordinate insulation installation with the fire stopping material manufacturer's UL approved installation instructions.

3.04 FIBER GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes:

1. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
2. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples.
3. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe fittings using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
4. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide an installation that maintains vapor barrier.
5. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
6. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

C. Insulate instrument connections for thermometers, pressure gauges, pressure temperature taps,

test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.05 FLEXIBLE ELASTOMERIC PIPE INSULATION

A. Seal longitudinal seams and end joints with the manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Insulate pipe fittings using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 LAVATORY PIPING COVERS

A. Contractor shall refer to Architectural details to insure all handicapped sinks and lavatories are insulated per ADA requirements.

3.07 PVC JACKETS

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with the manufacturer's recommended adhesive.

3.08 ALUMINUM JACKETS

A. Apply aluminum jacket waterproofing membrane on all exterior piping. Install in accordance with manufacturer's instructions and recommendations at locations indicated in the specifications and on the drawings.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by jacket manufacturer.

3.09 INSULATED PIPE SUPPORTS

A. 360° pre-molded insulation pipe supports shall be installed on piping 1 ½” and larger at hangers. Pipe insert thickness shall be equal to the adjoining insulation thickness. The length of supports shall be as follows:

Pipe Size	**Insulation Insert Length**	**Shield Length**	**Shield Gauge**
1 ½” to 5”	6”	4”	20 ga.
6" to 8"	9"	6”	16 ga.
10” to 12”	9”	6”	14 ga.
14” and larger	12”	10”	12 ga.

3.10 INSULATION SHIELDS

A. 6” long insulation shields shall be applied between hangers or supports and the pipe insulation insert for all insulated piping less than 1 ½” in diameter.

3.11 FIBER GLASS PIPE INSULATION THICKNESS:

Piping System	Continuous Vapor Barrier	Pipe Size			
		≤ 1½"	2” – 4”	5” - 6”	≥8”
Cold Water	Yes	1”	1”	1”	1”
Hot Water	No	1”	1”	1”	1”
Hot Water Recirculation	No	1”	1”	1”	1”
Tempered Water	No	1”	1”	1”	1”
Roof Drains	Yes	1”	1”	1”	1”
Purified Water	Yes	1”	1”	1”	1”

3.12 FLEXIBLE ELASTOMERIC PIPE INSULATION THICKNESS:

A. The roof drain and overflow drain bowls shall be insulated with 3/4" thick flexible elastomeric pipe insulation.

End of Section 22 07 16

SECTION 22 11 00 – DOMESTIC WATER PIPE AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the pipe and fittings as specified and indicated on the drawings.

1.02 QUALITY ASSURANCE

A. Welders Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing.

B. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.

C. Soldering and Brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Plumbing Refrigeration.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

F. Cross-Linked Polyethylene (PEX) plastic tubing and fittings shall conform to the following:

1. ASTM F876 specification for Cross-linked Polyethylene (PEX) Tubing
2. ASTM F877 specification for Cross-linked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems
3. ASTM F2023 test method for evaluating the oxidative resistance of Cross-linked (PEX) tubing and systems to hot chlorinated water
4. ASTM F1807 specification for metal insert fittings utilizing a copper crimp ring for SDR9 Cross-linked Polyethylene (PEX) tubing
5. ASTM E84 surface burning characteristics of building materials
6. CSA-B137.5 Cross-Linked Polyethylene (PEX) tubing systems for pressure applications
7. NSF 14 - Plastic Piping Components and Related Materials
8. NSF 61 - Drinking Water System Components - Health Effects
9. AWWA C651 Standard for Disinfecting Water Mains
10. ICC International Plumbing Code and/or IAPMO Uniform Plumbing Code

1.03 QUALITY ASSURANCE (PEX)

A. The PEX tubing and fitting manufacturer shall maintain a third party listing of the tubing and fittings. The tubing and fittings shall be certified in accordance with NSF 61 to verify suitability to transport potable water. The tubing and fittings shall have the mark “NSF-pw” or “NSF 61” permanently marked on the product to verify the material listing.

B. The PEX tubing and fitting manufacturer shall maintain a quality control program in accordance with ISO 9001 in the manufacturing plant to assure that the tubing and fittings are continually being produced to the required standard. The tubing and fittings shall be certified as complying with NSF 14.

C. The installer shall be a qualified licensed plumber in the jurisdiction and familiar with the installation of PEX tubing systems.

1.04 DELIVERY, STORAGE AND HANDLING (PEX)

A. Protect PEX tubing, fittings and manifolds during shipping to the job site. Unload with care at the job site and store in a flat, dry, well ventilated location. PEX tubing shall be stored under cover

protected from exposure to direct and indirect sunlight exposure. Care shall be taken in handling to avoid damage to the tubing, fittings and manifolds.

1.05 WARRANTY (PEX)

A. The manufacturer shall warrant that the tubing and fittings are free from defects and conform to the designated standards.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for domestic water pipe and fittings in this specification are as listed below and shall represent the minimum level of construction. Equipment manufactured by Victaulic, Viega ProPress and Wheatland shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 ABOVE GRADE PIPING AND FITTINGS

A. The following shall be acceptable piping methods for all discharge pipe from relief valves, sump pumps as well as all non-potable domestic water lines 4" and smaller:

1. Type L hard copper pipe with sweat type fittings and 50/50 solder connections.
2. Type L hard copper pipe with copper and copper alloy fittings shall conforming to ASME B16.18 or B16.22 as well as IAPMO PS117 may be used. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed by fitting manufacturer. Press end shall have smart connect feature. Viega ProPress.

B. The following shall be acceptable piping methods for all potable domestic water lines 4" and smaller:

1. Type L hard copper pipe with sweat type fittings and 95/5 solder or Silfos brazed connections.
2. Type L hard copper pipe with copper and copper alloy fitting shall conforming to ASME B16.18 or B16.22 as well as IAPMO PS117 may be used. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed by fitting manufacturer. Press end shall have smart connect feature. Viega ProPress or approved equal,.
3. Schedule 5 stainless steel piping may be used with type 304/304L, with Vic-Press 304™ precision, cold drawn, austenitic stainless steel fittings with elastomer O-ring seal.
4. Type L hard copper with push-to-connect fittings may be used. Fittings shall be wrought copper or cast bronze with EPDM seals and 301 stainless steel internal components. Victaulic PermaLynx or approved equal,
5. Copper-tube dimensioned grooved joint fittings conforming to ASME B16.18 or B16.22, with Installation-Ready couplings suitable for direct stab installation without field disassembly. Victaulic Copper-Connection with Style 607 Quick-Vic Couplings.
6. PEX High-Density Cross-linked Polyethylene Tubing (Not allowed in return air plenums)
   A. PEX tubing shall be manufactured to the requirements of ASTM F876 and meet the standard grade hydrostatic pressure ratings from Plastic Pipe Institute in accordance with TR-4/03. The following three standard grade ratings are required.
      - 200°F at 80 PSIG
      - 180°F at 100 PSIG

- 73.4°F at 160 PSIG

B. Press fittings shall be manufactured from UNS, C87700, C87710 Bronze, meeting the requirements of ASTM F877 tested as a system with the PEX tubing. The press sleeve shall be manufactured from a 304 grade or better stainless steel. The press sleeve shall have a sight hole to ensure proper insertion.

C. Manifolds shall be copper material having a male or female solder or ProPress inlets. All outlets shall be Press or ProPress fittings. Manifolds shall be provided by the PEX system manufacturer.

D. PEX adapter fittings shall conform to ASTM F877 or CSA CAN3-B137.5. The adapter fittings shall mate to NPT threads, copper tubing, copper fitting or ProPress fittings.

7. Type L hard copper pipe with sweat type fittings and 50/50 solder connections.

8. Type L hard copper pipe with copper and copper alloy fittings shall conforming to ASME B16.18 or B16.22 as well as IAPMO PS117 may be used. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed by fitting manufacturer. Press end shall have smart connect feature. Viega ProPress.

2.03 ACCESSORIES (PEX)

A. Hangers and supports shall be designed for PEX tubing. The hangers and supports shall not have sharp edges or surfaces that can cut the tubing. Acceptable hangers include plastic u-clip tubing fasteners, suspension clip tubing fasteners, nylon clips and u-channel fasteners. Acceptable supports include drop ear bend supports, snap-in bend supports, plastic bend supports, plastic bend supports for slab and other supports specifically designed for PEX plastic tubing.

B. Penetration Protection: Penetrations of fire resistance rated walls, floors, or ceilings by PEX tubing shall be protected in accordance with UL and the requirements of the building code.

2.04

2.05 BELOW GRADE PIPE AND FITTINGS

A. Type K hard copper piping with silfos joints shall be used for all potable and domestic water piping below building slabs, including domestic service entrance lines 3” and smaller.

B. ANSI Class 50 and 51 cement lined ductile iron pipe, or C900 plastic, with mechanical joints shall be used for the domestic water service lines 4” and larger.

PART 3 EXECUTION

3.01 DOMESTIC WATER LINES (COPPER)

A. All runs of pipe shall be installed as shown on drawings, unless some condition should arise which would make it necessary or seem advisable to alter same; in which case, the architect or his representative must be consulted before making any change. No piping shall be buried unless shown as such as the drawings.

B. Exterior buried piping shall have a minimum of 42" cover.

C. Air chambers shall be provided on all water supplies near each faucet control valve or flush valve, except hose bibbs. Air chamber shall be equal in length to at least 12 diameters of the pipe.

D. Grooved joints shall be installed in accordance with the manufacturer’s latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The

grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).

3.02 DOMESTIC WATER LINES (PEX)

A. The installing contractor shall carefully examine the PEX tubing for defects or abuse including; cuts, gouges, kinks, abrasions, cracks, deformations, blemishes or fading color. Fittings and manifolds shall be checked for any signs of defect or abuse. Only install PEX tubing, fittings and manifolds that are free of defects or damage. Defective or damaged tubing, fittings or manifolds shall be rejected.

B. The plans indicate the general location and arrangement of PEX tubing systems. The indicated locations and arrangements are used to size pipe, calculate friction loss and other design considerations. Install PEX tubing as indicated, except where deviations to layout are approved in advance by the engineer.

C. Install PEX tubing, fittings and manifolds with a pressure rating equal to or greater than the system operating pressure.

D. Install PEX tubing in a workmanlike manner to avoid damage to the tubing and surrounding building surfaces and systems. Protect PEX to avoid abrasion and contact with surrounding building material.

E. Install PEX tubing with provision for expansion and contraction. PEX tubing shall not be installed in tight straight runs. Flexibility in the installation shall be provided to permit free expansion and contraction without damage to the PEX tubing or adjacent surfaces or systems.

F. Protect PEX tubing passing through a wall, floor, ceiling or partition by wrapping with pipe insulation or installing through an appropriately sized sleeve. Penetrations of fire rated assemblies shall maintain the rating of the assembly.

G. Where PEX tubing is indicated to be installed below grade, provide back fill material that is free of large rocks, glass or other sharp objects that could damage the PEX tubing.

H. Install PEX tubing a minimum of 6 inches horizontally and 12 inches vertically from any source of heat such as recessed lights and appliance or heater vents.

I. PEX tubing shall be cut with a PEX tubing cutter specific to this application. The tubing shall be cut square to permit proper joining with fittings.

J. Support PEX tubing shall at 32 inch intervals horizontally. Support PEX tubing at each floor/ceiling penetration and at 48 inch intervals vertically in between.

K. PEX tubing changes in direction shall not exceed eight times the tubing outside diameter (OD) free bend radius or five times the tubing OD supported bend radius with use of the manufacturer's approved bend support. Install fittings for changes in direction where any minimum bend radius is exceeded. Provide branch tubing connections in strict accordance with the manufacturer's recommendations.

L. Install press fittings in accordance with the manufacturer's installation instructions, using only the tools approved by the manufacturer.

M. Threaded joints shall have a potable water listed joint sealant tape applied to the male threads only.

N. Provide approved adapter fittings at connections between PEX tubing and other piping materials. Adapter fittings shall be connected by NPT threads, copper tubing, copper fitting or ProPress

fittings. Adapter fittings shall be installed in strict accordance with the manufacturer's installation instructions.

O. Connect PEX tubing to plumbing fixtures directly, with an adapter fitting or with flexible tubing connectors. Each fixture water supply shall have a supply stop to isolate the connection to the fixture.

P. PEX tubing systems shall have identification markings that conform to the ASTM F876 and NSF-pw, ES ER 5944 ES ER 5945 ES ER 5421 requirements.

Q. Manifolds and valves shall be located where easily accessible and not subject to freezing. Provide adequate room around the manifold to permit installation of the cross-linked polyethylene tubing and valves. Provide proper support using the manufacturer provided manifold brackets. Install manifolds in strict accordance with the manufacturer's installation instructions.

3.03 FIELD QUALITY CONTROL (PEX)

A. System Testing:

1. Water Testing: PEX tubing systems shall be pressure tested in accordance with local code after installation or to at least minimum system working pressure, no less than 40 PSI, and for a period of no less than 15 minutes. Water used for this testing shall come from a potable water source. Test should not exceed pressure rating of PEX tubing and shall have no leaks.
2. Air Testing: In lieu of a water test, PEX tubing system shall be air tested in accordance with local code after installation, or at least system working pressure, no less than 40 PSI and no greater than 100 PSI. The test shall be conducted for a period of no less than 15 minutes and no greater than an hour and not leak more than 8 PSI over the test duration. Refer to the manufacturers' installation instructions for safety considerations while conducting air testing.

3.04 CLEANING AND DISINFECTION (PEX)

A. The PEX water distribution systems shall be disinfected prior to being placed in service. Follow the time limitations and exposure levels listed below:

1. Flush the system with potable water until discolored water does not appear at any of the outlets.
2. Fill the system with a water chlorine solution containing at least 50 parts per million of chlorine. The system shall be isolated and to stand for 24 hours.
3. Alternate: The system shall be filled with water chlorine solution containing at least 200 parts per million of chlorine. The System shall be isolated and allowed to stand for 3 hours.
4. Following the standing time, the system shall be flushed with potable water until the chlorine is purged from the system.

3.05 EXPOSED AND CONCEALED PIPING

A. All piping shall be concealed in walls, below floors or above ceilings unless specifically noted or indicated otherwise or shown in areas with exposed structure. All pipe shall be installed parallel or perpendicular to building surfaces.

End of Section 22 11 00

SECTION 22 11 15- NATURAL GAS PIPING AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the natural gas pipe and fittings as specified and indicated on the drawings.

1.02 QUALITY ASSURANCE

A. Welders Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing. Welders of steam and condensate return piping shall be holders of ASME 'R' and 'PP' or 'S' stamps.

B. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.

PART 2 PRODUCTS

2.01 ABOVE GRADE PIPING AND FITTINGS

A. Schedule 40 grade, ASTM A-53, butt weld black steel pipe with either welded or threaded malleable fittings shall be used for above grade gas piping. Flexible gas piping in maximum 24” lengths will be required at final connections to all gas appliances.

B. Flexible gas piping shall be corrugated stainless steel tubing, ASTM A240 type 304 – 321, with a minimum wall thickness of .010, complying with ANSI/IAS LC-1 Standard for fuel Gas Piping using Corrugated Stainless Steel Tubing (CSST), CSA International Report No. 1898978-1009875, ICBO Evaluation Report ER-5122, and IAPMO Research Report File No. C-3250. Jacketing shall be Tenite polyethylene meeting the requirements of ASTM E84 for flame spread and smoke density.

2.02 BELOW GRADE PIPE AND FITTINGS

A. Buried gas piping shall be Plexco PE2406, SDR11, polyethylene with #12 copper tracer wire and anodeless risers where rising above grade.

PART 3 EXECUTION

3.01 GAS PIPING

A. Gas piping shall be installed as shown with all exterior buried piping with a minimum of 24" cover.

B. Provide a union, gas valve, and scale pocket at each equipment connection. Final connections to equipment shall be made with a 24” length of flexible gas piping

C. All fittings in flexible gas lines shall be SAE CA360 brass incorporating double wall flare for sealing and Jacket Lock jacket capturing for steel tubing protection. Installation shall be in full accordance with the current edition of Gastite Design and Installation Guide.

End of Section 22 11 15

SECTION 22 11 19 – DOMESTIC WATER SPECIALTIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the domestic water specialties as specified and indicated on the drawings.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the domestic water specialties in this specification are Febco/Watts and Leonard and shall represent the minimum level of construction. Products manufactured by Stiebel Eltron, Symons, Powers, Cash Acme, Zurn, Prier, Wade, Smith, or Josam shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 REDUCED PRESSURE STYLE BACKFLOW PREVENTER – ¾” TO 2”

A. Provide Febco LF825Y, or approved equal, reduce pressure backflow preventer where indicated at hydronic system make-up connections and domestic water service entrance.

B. Reduced pressure backflow preventer assemblies shall consist of two independent "Y" configured check valves and one differential relief valve.

C. By design, the assembly shall automatically reduce the pressure in the zone between the checkvalves. Should the differential between the zone and upstream pressure drop to 2 PSI, the differential relief valve will open, maintaining proper zone differential.

D. All internal metal parts included in the check assemblies shall be bronze and shall not contain any dissimilar metals. Elastomeric seat discs on the checks and relief valve must be reversible, and seat rings shall be B-61 bronze. The check assembly shall be center stem guided at the seat ring and at the cover by replaceable non-corrosive bushings. Relief valve spring is to be Series 300 stainless steel.

E. Head losses through the assembly shall not exceed 12.5 PSI at velocities from zero up to and including 7.5 FPS. Flow curves shall be documented by independent laboratory testing.

F. Valve bodies and caps including relief valve body and cover shall be bronze.

G. Reduced pressure backflow preventer assemblies including shutoff valves and test cocks shall be full ported ball valves. Assemblies must be factory assembled and backflow tested.

H. The assembly shall be constructed so that check valve and relief valve components may be serviced without removing the valve body from the line. All seat discs shall be reversible. The assembly shall be rated 175 MWWP (32 degrees F. to 140 degrees F.).

I. Relief valve assembly shall be of a modular design for ease of maintenance.

J. The assembly shall meet or exceed requirements of ASSE Standard 1013, AWWA Standard C511, CSA Standard B64.4 and the USC Foundation for Cross Connection Control and Hydraulic Research.

2.03 REDUCED PRESSURE STYLE BACKFLOW PREVENTER – 2 ½” TO 10”

A. Provide Febco LF860, or approved equal, reduce pressure backflow preventer where indicated at hydronic system make-up connections and domestic water service entrance.

B. Reduced pressure backflow preventer assemblies shall consist of two independent "Y" configured check valves and one differential relief valve.

C. By design, the assembly shall automatically reduce the pressure in the zone between the checkvalves. Should the differential between the zone and upstream pressure drop to 2 PSI, the differential relief valve will open, maintaining proper zone differential.

D. All internal metal parts included in the check assemblies shall be of Series 300 stainless steel and shall not contain any dissimilar metals. Elastomeric seat discs on the checks and relief valve must be reversible, and seat rings shall be B-61 bronze, or Series 300 stainless steel. The check assembly shall be center stem guided at the seat ring and at the cover by replaceable non-corrosive bushings. Relief valve spring is to be Series 300 stainless steel.

E. Head losses through the assembly shall not exceed 12.5 PSI at velocities from zero up to and including 7.5 FPS. Flow curves shall be documented by independent laboratory testing.

F. Valve bodies and cover shall be manufactured of ductile iron ASTM A536, Grade 65-45 12 and shall be designed to withstand a 10-1 safety factor over rated cold water working pressure, Ductile iron bodies shall be flanged, ANSI B16.1, Class 125, epoxy coated internally 10-20 mils.

G. All orifices of the pressure sensing passages must be located out of the normal debris flow path or settling areas. External sensing tubing shall be copper, ASTM B280.

H. Reduced pressure backflow preventer assemblies shall include flange, full port resilient wedge shut-off valves and four vandal resistant ball valve testcocks, considered integral to the assembly. Assemblies must be factory assembled and backflow tested.

I. The assembly shall be constructed so all internal parts, including seat rings, can be serviced from the top or side or removed while assembly is in line. The assembly shall be rated 175 MWWP (32°F to 140°F).

J. Relief valve assembly shall be of a modular design for ease of maintenance.

K. The assembly shall meet or exceed requirements of ASSE Standard 1013, AWWA Standard C506-78, and the USC Foundation for Cross Connection Control and Hydraulic Research.

2.04 PRESSURE REDUCING VALVES

A. Provide two Watts, or approved equal Cash Acme, water pressure reducing valves in parallel.

B. Pressure reducing valves shall be model #223 and rated as listed below with a maximum 15 PSI fall off pressure.

1. Greater than 1 ½” shall be #223- 2 ½” rated for 90 GPM and set for 70 PSI
2. Less than 1 ½” shall be #223- 1 ¼” rated for 40 GPM and set for 75 PSI

2.05 HOSE BIBBS

A. Provide Woodford, or approved equal Zurn, Prier, Wade, Smith, or Josam hose bibbs as follows:

1. Exterior: Woodford #65C (self-draining with vacuum breaker).
2. Interior: Zurn S-1333 key operated, vandal resistant interior hose bibb with vacuum breaker.

2.06 SHOCK STOPS

A. Provide Precision Plumbing Products, or approved equal, Model SC water hammer arrestors sizes as noted on the plans and required by the plumbing code.

2.07 TEMPERING VALVES - POINT OF USE LARGE

A. Tempering valves shall be equal to Leonard, or approved equal, Model TM-186-30TA-PRV-RF-0 thermostatic mixing valve with adjustable high limit stop set for 110°F. Provide with inlet

manifold piping, color coded outlet thermometer, and outlet pressure regulating valve.

B. Unit shall be designed for ¾" inlets, 1" tempered outlet rated for a maximum of 30 GPM flow with a 20 PSI system pressure drop and guaranteed stable minimum flow rate of 2.0 GPM.

2.08 TEMPERING VALVES –POINT OF USE INDIVIDUAL LAVATORIES

A. Tempering valves shall be equal to Leonard, or approved equal, Model 170-LF ASSE 1070 and LF certified thermostatic mixing valve with adjustable and locking high limit stop set for 110°F. Valve shall be provided with integral check valves on the hot and cold inlets.

B. Unit shall be designed for 3/8" hot and cold inlets and 3/8" tempered outlet rated for a maximum of 3 GPM flow with a 20 PSI system pressure drop, and guaranteed stable minimum flow rate of 0.25 GPM

2.09 TEMPERING VALVES

A. Tempering valves shall be equal to Leonard, or approved equal, Model TM-186-20050-PRV-RF thermostatic mixing valve with adjustable high limit stop set for 140°F. Provide with inlet manifold piping, color coded outlet thermometer, and outlet pressure regulating valve.

B. Unit shall be designed for 2" inlets, 2" tempered outlet rated for a maximum of 180 GPM flow with a 20 PSI system pressure drop and guaranteed stable minimum flow rate of 5.0 GPM.

2.10 DOMESTIC WATER EXPANSION TANK

A. Provide Watts, or approved equal, Model DET-12 pneumatic pre-pressurized diaphragm type expansion tank rated for 4.8 gallon volume and 3.0 gallon acceptance volume at 40 PSI.

PART 3 EXECUTION

3.01 TEMPERING VALVE INSTALLATION

A. All aspects of the installation of the tempering valves, including but not limited to recirculation, shall be in strict accordance with the manufacturer's instructions. Materials used shall conform with all manufacturers recommendations

B. Piping diagrams indicated on plans are based on Leonard and shall be modified as approved by the engineer via shop drawings for other manufacturers.

End of Section 22 11 19

SECTION 22 11 23 – DOMESTIC WATER PUMPS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all domestic water pumps as specified, indicated or scheduled on the drawings.

1.02 SHOP DRAWINGS

A. Shop drawings shall be submitted as specified in Division 1.

B. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:

1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
2. Capacity, pressure drop, RPM, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
3. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the equipment in this specification is Bell and Gossett and shall represent the minimum level of construction. Equipment from Taco, Thrush, Armstrong, and Patterson shall be permitted to bid these specifications

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 IN-LINE DOMESTIC WATER CIRCULATORS

A. General Description: Circulators shall be horizontal inline, centrifugal, separately-coupled, single-stage, bronze-fitted, radially split case design, with mechanical seals, and rated for 125 PSIG working pressure and 225°F continuous water temperature.

B. Casings Construction: Bronze, with threaded companion flanges for piping connections smaller than 2 ½ inches, and threaded gauge tappings at inlet and outlet connections.

C. Impeller Construction: Statically and dynamically balanced, closed, overhung single-suction, fabricated from cast bronze conforming to ASTM B 584, and keyed to shaft.

D. Impeller Construction: Statically and dynamically balanced, closed, overhung, single-suction, fabricated from Rolled Temper brass conforming to ASTM B 36, and keyed to shaft.

E. Pump Shaft and Sleeve: Steel shaft, with copper sleeve. Provide flinger on motor shaft between motor and seals to prevent liquid that leaks past pump seals from entering the motor bearings.

F. Mechanical Seals: Carbon steel rotating ring, stainless steel spring, ceramic seat, and flexible bellows and gasket.

G. Pump Shaft Bearings: Oil-lubricated, bronze journal and thrust bearings.

H. Pump Couplings: Flexible, capable of absorbing torsional vibration and shaft misalignment.

I. Motors: Resiliently mounted to the pump casing.

2.03 AQUASTAT

A. NEMA 1 enclosure with sealed dust-protected switch, integral surface mount sensing element

insulated from control case, single pole double throw (SPDT) snap acting, mounting bracket with straps, adjustable set point (100°F to 240°F) with adjustable differential. Rated for 10.0 full load amps at 120V, 125 VA (24 to 277VA) pilot duty.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation and support shall comply with the manufacturer's written installation instructions.

B. Install pumps and aquastats in locations and arranged to provide access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.

3.02 CONNECTIONS

A. General: Install valves that are same size as the piping as indicated on the drawings.

B. Install suction and discharge pipe sizes equal to or greater than the diameter of the pump nozzles.

C. Install a non-slam check valve and shutoff valve on the discharge side of pumps.

D. Install a isolation valve and strainer on the suction side of inline pumps.

E. Install surface mounted aquastat on bare metal pipe, fastened securely to pipe upstream of circulator pump when indicated on the drawings.

F. Interlock the aquastat and/or timer with hot water recirculation pump motor. Electrical wiring and connections are specified in Division 26 section.

G. Install pumps and remote sensors as recommended by the manufacturers. Coordinate interlock of the sensors and pump.

3.03 AQUASTAT SETTINGS

A. Refer to drawings for job specific requirements

B. Typical Settings:

1. Domestic Water: Pump on at 95°F and off at 109°F. Tempered Water Supply: 114°F
2. Kitchen Applications: Pump on at 125°F and off at 139°F. Tempered Water Supply: 140°F

End of Section 22 11 23

SECTION 22 13 00 – SANITARY PIPE AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the pipe and fittings as specified and indicated on the drawings.

1.02 SHOP DRAWINGS

A. Shop drawings shall be submitted as specified in Division 1.

B. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:

1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the material in accordance with the latest adopted version of CISPI Standard 301 or ASTM A888 or ASTM A74.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the equipment in this specification is Charlotte Pipe and shall represent the minimum level of construction. Equipment from ABI and Tyler Pipe shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 ABOVE GRADE PIPING AND FITTINGS

A. Where allowable by Local Codes, Schedule 40 PVC drain waste and vent piping with solvent welded joints shall be used for all soil, waste and vents lines located above grade. All changes in directions shall be made by the use of 45 wyes, half wyes, long sweep 1/4 bends, 1/6, 1/8, or 1/16 bends. Sanitary tees may be used where the changes in direction of flow are from horizontal to vertical. Where space conditions necessitate the use of short radius fitting, approval shall be obtained before installation

B. Service weight centrifugally cast iron soil pipe, ASTM A888 and/or CISPI 301 listed, with "NO-HUB" joints shall be used for soil, waste and vent lines. All changes in direction shall be made by the use of 45 wyes, half wyes, long sweep l/4 bends, 1/6, 1/8, or 1/16 bends. Sanitary tees may be used where the changes in direction of flow is from horizontal to vertical. Where space conditions necessitate the use of short radius fitting, approval shall be obtained before installation.

C. Couplings for joining hubless cast iron pipe and fittings conforming to ASTM Q-888, shall be 3 inches wide for nominal pipe sizes 1 ½ to 4 inches in diameter, 4 inches wide for nominal sizes 5 to 10 inch diameter, and 5 5/8 inches wide for couplings 12 and 15 inches in diameter.

1. Shields shall have a minimum thickness of 0.015 inches, (28 gauge) type 304 stainless steel. Worm drive clamps shall be type 304 stainless steel with a minimum clamp torque of 80 in/lbs.
2. Sealing gasket shall be neoprene conforming to ASTM C-564.
3. Couplings shall conform to FM standard 1680, Class 1, or ASTM C-1540 and shall be manufactured by Clamp-All Products Model Hi-Torq 125 and Hi-Torq 80, or equal Husky Technologies Model SD-4000.
4. Install pipe and fittings per the Cast Iron Soil Pipe Institute Designation 3011. Restrain

pipe and fittings 4” and larger, per Code, with engineered products installed as per manufacturer’s recommendations.

D. Galvanized pipe shall be used from the tapped sanitary tee through wall to fountain and sink trap connections.

2.03 BELOW GRADE PIPE AND FITTINGS

A. Service weight centrifugally cast iron soil pipe, ASTM A888 and/or CISPI 301 listed, with "TY-SEAL" joints shall be used for soil, waste and vent lines. All changes in direction shall be made by the use of 45 wyes, half wyes, long sweep l/4 bends, 1/6, 1/8, or 1/16 bends. Sanitary tees may be used where the changes in direction of flow is from horizontal to vertical. Where space conditions necessitate the use of short radius fitting, approval shall be obtained before installation. Service weight centrifugally cast iron soil pipe, bearing the mark of the Cast Iron Institute, with "NO-HUB" joints shall be used for soil, waste, vent, and roof drain lines only when provided with couplings conforming to ASTM Q-888, shall be 3 inches wide for nominal pipe sizes 1 ½ to 4 inches in diameter, 4 inches wide for nominal sizes 5 to 10 inch diameter, and 5 5/8 inches wide for couplings 12 and 15 inches in diameter.

1. Shields shall have a minimum thickness of .015 inches, (28 gauge) type 304 stainless steel. Worm drive clamps shall be type 304 stainless steel with a minimum clamp torque of 80 in/lbs.
2. Sealing gasket shall be neoprene conforming to ASTM C-564.
3. Couplings shall conform to FM standard 1680, Class 1, or ASTM C-1540 and shall be manufactured by Clamp-All Products Model Hi-Torq 125 and Hi-Torq 80, or equal Husky Technologies Model SD-4000.
4. Install pipe and fittings per the Cast Iron Soil Pipe Institute Designation 3011. Restrain pipe and fittings 4” and larger, per Code, with engineered products installed as per manufacturer’s recommendations.

B. Where allowable by Local Codes, Schedule 40 PVC drain waste and vent piping with solvent welded joints shall be used for all soil, waste and vents lines located below and outside of the building slab. All changes in directions shall be made by the use of 45 wyes, half wyes, long sweep 1/4 bends, 1/6, 1/8, or 1/16 bends. Sanitary tees may be used where the changes in direction of flow are from horizontal to vertical. Where space conditions necessitate the use of short radius fitting, approval shall be obtained before installation

PART 3 EXECUTION

3.01 SOIL, WASTE AND VENT LINES

A. The arrangement of the systems must be as direct as possible avoiding all unnecessary offsets. All pipe shall run as indicated on the drawings, unless some condition should arise which would make it necessary or seem advisable to alter same; in which case, the Architect or his representative must be consulted before making any change. Horizontal lines shall be graded at 1/8" per foot, unless noted otherwise. Where necessary, lines may pitch at 1/10" per foot when approved or noted.

B. Every vent for traps shall be connected to the waste line by as short a connection as possible, but in no case shall such connections have a length greater than 2' in length, measuring horizontally from the center of the fixture to the vent. Horizontal vents shall connect into the main stack at least 18" above the highest fixture.

C. Each fixture and piece of equipment requiring connection to the sanitary drainage system shall be equipped with a trap. Each trap shall be placed as near the fixture as possible and no fixture shall be double-trapped.

D. All piping shall be installed in strict compliance with all adopted building codes as well as manufacturer's recommendations.

3.02 EXPOSED AND CONCEALED PIPING

A. All piping shall be concealed in walls, below floors, or above ceilings unless indicated otherwise or shown running through areas with exposed structure.

B. All pipe shall be installed parallel, perpendicular or a 45degree angle to building surfaces.

End of Section 22 13 00

SECTION 22 13 19 - SANITARY SPECIALTIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the sanitary system specialties as specified and indicated on the drawings.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the cleanouts and drains in this specification is Zurn and shall represent the minimum level of construction. Products manufactured by Smith, Wade, Josam, Watts Drainage, and Stiebel Eltron shall be permitted to bid these specifications

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 CLEANOUTS

A. Provide approved equal, cleanouts where shown. Cleanouts shall be the same size pipe for pipe 4" and smaller, and 4" for lines 4" and larger.

B. Cleanouts shall be as follows:

1. Floor and exterior cleanouts shall be set in 24" x 24" x 4" concrete pad for exterior use.
2. Wall cleanouts shall be "NO-HUB" caps behind 10 x 10 nickel bronze with polished top.

C. Provide top material and/or finish(es) as directed by the architect. Cleanouts shall be provided with carpet covers where applicable.

2.03 FLOOR DRAINS

A. Floor drains shall be provided with deep seal trap and shall be as scheduled on the drawings. Trap material shall match that of system connection.

B. Unless noted otherwise, or specifically excluded by code, provide equal, inline floor drain trap seal having ASSE 1072 approved listing. Products not having the ASSE 1072 approved listing will not be accepted.

C. Provide grate material and/or finish(es) as directed by the architect.

2.04 FLOOR SINKS

A. Floor sinks shall be provided with deep seal trap and shall be as scheduled on the plans. Trap material shall match that of system connection.

B. Unless noted otherwise, or specifically excluded by code, provide equal, inline floor drain trap seal having ASSE 1072 approved listing. Products not having the ASSE 1072 approved listing will not be accepted.

C. Provide top grate material and/or finish(es) as directed by the architect.

2.05 BACKWATER VALVES

A. Provide backwater valve with dura-coated cast iron body, hub inlet and open outlet for installation at end of drainage line. Provide with automatic type valve seat which hangs closed during periods of non-operation.

PART 3 EXECUTION

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End of Section 22 13 19

SECTION 22 30 00 – WATER SOFTENERS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide a complete and operating water softener system as hereinafter specified and indicated on the drawings

1.02 SHOP DRAWINGS

A. Shop drawings shall be submitted as specified in Division 1.

B. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:

1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
2. Capacity, pressure drop, RPM, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
3. Dimensional drawings showing layout, connection points, and detailed layout of components.
4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the pumping equipment in this specification Culligan and shall represent the minimum level of construction. Equipment from US Filter and US Water Systems shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 WATER SOFTENER

A. The system will have a softener capacity of not less than 150,000 grains of softening capacity per regeneration when a salt dosage of 80 pounds per tank is used.

B. The softener resin tank will be 24 inches in diameter. The sideshell height will be 48 inches, sufficient to allow a minimum freeboard space of 50 percent of the resin bed depth for adequate expansion of the resin during backwashing. Each tank will be designed for a working pressure of 100 PSI and hydrostatically tested at 50 percent in excess of the working pressure. Each will be equipped with a removable opening in the top head for media filling purposes. Steel tanks will be provided with a 4 mil thick phenolic epoxy to protect against internal corrosion. The tank exterior will be painted with a two-part epoxy finish to protect against external corrosion.

C. Each softener tank will be equipped with a soft water collector and backwash water distributor consisting of a plastic riser pipe with a fine-slotted plastic strainer attached to the bottom of the pipe, covered with a minimum of 3 inches of underbed sand to ensure even distribution of water. Each softener tank will be equipped with an upper distributor that distributes water laterally to ensure maximum water softening capacity.

D. Each softener tank will be provided with 8 cubic feet of resin having a minimum exchange capacity of 24,000 grains per cubic foot when regenerated with 15 pounds of salt. The media shall be solid, of the proper particle size (not more than 4% through 40 mesh U.S. standard screens,

wet screening) and will contain no agglomerates, shells, plates, or other shapes that might interfere with the normal function of the water softener. The resin will be manufactured to comply with the food additive regulation, 21CFR173.25 of the Food and Drug Administration.

E. A combination salt storage and brine tank shall be provided. The tank will be 24" diameter x 48" tall and molded of corrosion-proof, high-density polyethylene. The brine tank will be equipped with an elevated salt plate for brine collection, and a chamber to house a brine valve assembly. The brine valve will automatically open to admit brine to the resin tank during education and close automatically to prevent introduction of air into the resin tank. During refill, the brine valve will regulate the flow of soft water into the brine tank, working with the timed refill feature of the softener control valve; together these components will admit the correct volume of water to the brine tank in accordance with the salt dosage settings on the control valve. The brine valve will include a float-operated safety shut-off valve, as a back-up to the time refill valve on the control, to prevent brine tank overflow.

F. The main control valve will be 3 inch pipe size, of the hydraulically actuated, 4-position type to accomplish the regeneration steps of backwash, brine-slow rinse, rapid rinse and service. It will be all brass for corrosion resistance. The valve will include all fixed and self-adjusting flow regulators to properly control the rate of flow during the backwash and brine-rinse on pressures between 30-100 PSI.

G. All timer control will be UL listed with a 2" turbine meter to allow the two tanks to regenerate on an alternating basis.

PART 3 EXECUTION

End of Section 22 30 00

SECTION 22 34 00 – GAS FIRED WATER HEATERS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide water heating equipment as specified and as indicated on the drawings.

1.02 SHOP DRAWINGS

A. Shop drawings shall be submitted as specified in Division 1.

B. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:

1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
2. Capacity, pressure drop, RPM, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
3. Dimensional drawings showing layout, connection points, and detailed layout of components.
4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the water heating equipment in this specification is A.O. Smith and shall represent the minimum level of construction. Equipment from Laars, Rheem, or State shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 WATER HEATER - HIGH EFFICIENCY GAS FIRED

A. Water heater shall be high efficiency gas fire instantaneous type heater as scheduled on plans with glass lined storage tank.

B. Provide with 100 % gas safeties, 120 volt electronic controls, brass drain valve in tapping, and temperature pressure relief valve.

C. Unit shall be direct vent/sealed combustion unit consisting of a separate CPVC exhaust vent and PVC air intake lines arranged for direct venting or concentric venting with manufacturer's concentric venting kit.

D. Vent connectors shall use PVC for combustion air and CPVC for exhaust flue in sizes per manufacturer's recommendations. Provide with standard concentric wall or roof terminations as indicated on the plans and installed per manufacturer's recommendations.

PART 3 EXECUTION

3.01 WATER HEATER INSTALLATION

A. All aspects of the installation of the water heaters shall be in strict accordance with the manufacturer's instructions. All materials used shall conform to manufacturer's recommendations.

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End of Section 22 34 00

SECTION 22 42 00 - PLUMBING FIXTURES AND TRIM

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all fixtures complete as indicated. Fixtures shall be set firm and true, connected to all pipe and ready for use. Fixtures shall be of one manufacturer throughout the entire installation, unless otherwise specified.

B. Quarter Turn Ball Stop valves shall be provided on the hot and cold water connections to all plumbing fixtures.

C. Braided stainless steel flex connections shall be limited to 12” long.

D. Refer to elevation on Architect's drawings for installation height of wall-mounted fixtures.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of ANSI Standard A117.1, "Buildings and Facilities -- Providing Accessibility and Useability for Physically Handicapped People," and Public Law 90-480, "Architectural Barriers Act, 1968," with respect to plumbing fixtures for the physically handicapped.

B. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

1. The terms "listed" and "labeled" shall be as defined in the National Electrical Code, Article 100.
2. SUBPARAGRAPH BELOW IS REQUIRED BY SOME FEDERAL AGENCIES.Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Design Concept: The drawings indicate types of plumbing fixtures and are based on the specific descriptions, manufacturers, models, and numbers indicated. Plumbing fixtures having equal performance characteristics by other manufacturers may be considered provided that deviations in dimensions, operation, color or finish, or other characteristics are minor and do not change the design concept or intended performance as judged by the Architect. Burden of proof for equality of plumbing fixtures is on the proposer.

1.03 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below matching products installed, packaged with protective covering for storage, and identified with labels clearly describing contents.

B. Faucet Washers and O-rings: Furnish quantity of identical units not less than 10 percent of amount of each installed.

C. Faucet Cartridges and O-rings: Furnish quantity of identical units not less than 5 percent of amount of each installed.

D. Provide a hinged-top wood or metal box, or individual metal boxes, having a separate compartment for each type and size of above extra materials.

E. Water Closet Tank Repair Kits: Furnish quantity of identical flush valve units not less than 5 percent of amount of each type installed.

F. Toilet Seats: Furnish quantity of identical units not less than 5 percent of amount of each

type toilet seat installed.

G. Filter Cartridges: Furnish quantity of identical filter cartridges not less than 50 percent of amount of each type and size installed.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the fixtures in this specification are those named and shall represent the minimum level of construction. Fixtures from Eljer, American-Standard, Crane, Gerber and Kohler shall be permitted to bid these specifications. The basis for the fixture carriers in this specification are those named and shall represent the minimum level of construction. Products manufactured by Zurn, Smith, Wade, Josam, Watts Drainage, and Stiebel Eltron shall be permitted to bid these specifications

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 PLUMBING FIXTURES

A. Fixtures shall be as scheduled on the drawings.

2.03 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products in each category, by one of the following listed for that category:

1. Water Closets:
   a. American Standard, Inc.
   b. Crane Plumbing/Fiat Products.
   c. Eljer; A Household International Co.
   d. Gerber Plumbing Fixture Corp.
   e. Kohler Co.
   f. Sloan
   g. Toto
2. Urinals:
   a. American Standard, Inc.
   b. Crane Plumbing/Fiat Products.
   c. Eljer; A Household International Co.
   d. Gerber Plumbing Fixture Corp.
   e. Kohler Co.
   f. Sloan
   g. Toto
3. Lavatories:
   a. Acorn Engineering Co.
   b. American Standard, Inc.
   c. Crane Plumbing/Fiat Products.
   d. Eljer; A Household International Co.
   e. Gerber Plumbing Fixture Corp.
   f. Just Manufacturing Co.
   g. Sloan
   h. Kohler Co.
4. Sinks:
   a. American Standard, Inc.

b. Crane Plumbing/Fiat Products.
c. Eljer; A Household International Co.
d. Elkay Manufacturing Co.
e. Just Manufacturing Co.
f. Kohler Co.

5. Service Sinks:
   a. Acorn Engineering Co.
   b. American Standard, Inc.
   c. Crane Plumbing/Fiat Products.
   d. Eljer; A Household International Co.
   e. Elkay Manufacturing Co.
   f. Just Manufacturing Co.
   g. Kohler Co.
6. Mop Basins:
   a. Aqua Glass Corp.
   b. Crane Plumbing/Fiat Products.
   c. Florestone Products Co., Inc.
   d. Stern-Williams Co., Inc.
7. Showers:
   a. Acorn Engineering Co.
   b. American Standard, Inc.
   c. Aqua Glass Corp.
   d. Aquarius Div.; Briggs Industries, Inc.
   e. Bradley Corp.
   f. Crane Plumbing/Fiat Products.
   g. Eljer; A Household International Co.
   h. Kohler Co.
8. Drinking Fountains:
   a. American Standard, Inc.
   b. Crane Plumbing/Fiat Products.
   c. Eljer; A Household International Co.
   d. Filtrine Manufacturing Co.
   e. Halsey Taylor; A Household International Co.
   f. Haws Drinking Faucet Co.
   g. Kohler Co.
9. Water Coolers:
   a. EBCO Manufacturing Co.
   b. Elkay Manufacturing Co.
   c. Filtrine Manufacturing Co.
   d. Halsey Taylor; A Household International Co.
   e. Haws Drinking Faucet Co.
   f. Sunroc Corp.
10. Wash Fountains:
    a. Acorn Engineering Co.
    b. Bradley Corp.
11. Outlet Boxes:
    a. Guy Gray Manufacturing Co., Inc.
    b. Symmons Industries, Inc.
12. Emergency Equipment:

a. Bradley Corp.
b. Guardian Equipment.
c. Haws Drinking Faucet Co.
d. Stingray

13. Toilet Seats:
    a. Bemis Mfg. Co.
    b. Beneke Div.; Sanderson Plumbing Products, Inc.
    c. Church Seat Co.
    d. Olsonite Corp.
14. Flushometers:
    a. Cambridge Brass Div.; EMCO Products; Masco Corp.
    b. Gerber Plumbing Fixture Corp.
    c. Sloan Valve Co.
    d. Zurn Industries, Inc.; Flush Valve Operations.
15. Commercial/Industrial Faucets:
    a. American Standard, Inc.
    b. Chicago Faucet Co.
    c. Crane Plumbing/Fiat Products.
    d. Eljer; A Household International Co.
    e. Grohe America, Inc.
    f. Kohler Co.
    g. Royal Brass Mfg. Co.
    h. T & S Brass and Bronze Works, Inc.
16. Pressure Balance Bath/Shower Faucets:
    a. American Standard, Inc.
    b. Bradley Corp.
    c. Chicago Faucet Co.
    d. Crane Plumbing/Fiat Products.
    e. Delta Faucet Co.; Div. of Masco Corp.
    f. Grohe America, Inc.
    g. Powers Process Controls.
    h. Leonard Valve Co.
    i. Symmons Industries, Inc.
17. Thermostatic Mixing Valve Bath/Shower Faucets:
    a. Bradley Corp.
    b. Grohe America, Inc.
    c. Leonard Valve Co.
    d. Powers Process Controls.
    e. Symmons Industries, Inc.
    f. T & S Brass and Bronze Works, Inc.
18. Shower Receptors:
    a. Aqua Glass Corp.
    b. Crane Plumbing/Fiat Products.
    c. Florestone Products Co., Inc.
    d. Stern-Williams Co., Inc.
19. Sensor-Operated Faucets and Devices:
    a. Acorn Engineering Co.
    b. Bradley Corp.
    c. Sloan Valve Co.

20. Supports:
    a. Josam Co.
    b. Smith (Jay R.) Mfg. Co.
    c. Wade Div.; Tyler Pipe
    d. Watts Drainage
    e. Zurn Industries, Inc.; Hydromechanics Div.
21. Disposers:
    a. General Electric Co.
    b. Hotpoint; General Electric Co.
    c. In-Sink-Erator Div.; Emerson Electric Co.
    d. Jenn-Air Co.
    e. KitchenAid, Inc.
22. Water Filters:
    a. EBCO Manufacturing Co.
    b. Filterite Div.; Memtec America Corp.
    c. Filtrine Manufacturing Co.
    d. Halsey Taylor; A Household International Co.
    e. Haws Drinking Faucet Co.
    f. Sunroc Corp
23. Penal (detention) Fixtures
    a. Acorn Engineering Co.

2.04 FAUCETS

A. Unless otherwise specified, provide faucets that are cast brass with finish to match basis of design faucet.

PART 3 EXECUTION

3.01 PLUMBING FIXTURES

A. Install plumbing fixtures and specified components, in accordance with designations and locations indicated on Drawings and in complete compliance with the manufacturer's recommendations and instructions.

B. Refer to elevations on the Architect's drawings for installation height of wall-mounted fixtures.

C. Refer to architectural plans to ensure flush valve control handle is mounted for use from the wide side of handicapped toilet stalls.

D. Set shower receptors and mop basins in leveling bed of cement grout.

E. Install stop valve in an accessible location in each water supply to each fixture.

F. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.

G. Seal fixtures to walls, floors, and counters using a sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

H. Operate and adjust all plumbing fixtures and equipment. Replace damaged and malfunctioning fixtures, fittings, and controls.

I. Clean fixtures, fittings, and spout and drain strainers with manufacturers' recommended cleaning methods and materials.

End of Section 22 42 00

SECTION 23 01 00 - GENERAL HVAC REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, General Requirements (Division 1) and Section 26 01 13 - Electrical Connections, apply to theSDF work specified in DIVISION 23 - HVAC

1.02 DESCRIPTION OF WORK

A. The Mechanical Contract includes all labor, materials and equipment required for the complete mechanical systems as shown and herein specified.

B. Provide all devices and accessories as necessary for complete and working systems.

C. The contractors shall become familiar with the work of all other trades and shall fully coordinate their work prior to ordering equipment or installation of systems.

D. The contractors shall become familiar with the work of all other trades and shall fully coordinate their work prior to ordering equipment or installation of systems.

E. The Contractor shall coordinate his work with that of all other trades in order to eliminate interferences. He shall examine the drawings in advance to determine the location of sprinklers, electrical systems, ducts, piping, structures, conduits, alarms, and other equipment and services to be installed, and properly coordinate the installation of his work to avoid interferences. The Engineers have considered existing interferences in making the drawings, but it is the responsibility of the Contractor to include in his bid proposal adequate allowances to modify, offset, or otherwise accommodate all equipment to the structure, utilities, and apparatus.

1.03 QUALITY ASSURANCE

A. Each major component of equipment shall have the manufacturer's name; address, model number and rating on a nameplate securely affixed.

B. All equipment of one type (such as fans, pumps, valves, etc.) shall be the products of one manufacturer, unless otherwise specified.

C. In the event of discrepancies between the drawings and specifications, the contractor shall advise the engineer before proceeding with the work in order that correct progress is ensued.

D. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel." Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 SHOP DRAWINGS AND SUBMITTALS

A. Shop drawings shall be submitted as specified in Division 1. Product data shall be submitted for all materials and equipment specified in DIVISION 23. Shop drawings and submittals must be submitted in PDF format and emailed to the design team.

B. Shop drawings for equipment ‘Packages” shall be complete and include all items to be provided by a manufacturer’s representative or supply house. No partial submittals will be reviewed or approved without a complete and total equipment submittal.

C. Each shop drawing shall include a letter indicating all deviations from the drawings and/or specifications.

D. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:

1. Product data listing manufacturer, model number, materials, and miscellaneous data as

required to describe the equipment.

2. Capacity, pressure drop, rpm, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
3. Dimensional drawings showing layout, connection points, and detailed layout of components.
4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.
5. Conspicuously mark on each submittal the exact model, fittings, accessories, and devices to be supplied. When a schedule is shown on the drawings or in the specifications, provide a copy of that schedule with the shop drawing indicating the equipment capacities and characteristics of the actual equipment being proposed.
6. Tags for equipment submitted shall match the tags indicated on the design drawings or specifications. Where equipment is noted on the drawings and not scheduled, refer to plan note and sheet number on the submittal.

E. Contractor shall check all shop drawings to verify that they meet the requirements of the drawings and specifications before forwarding to the architect and engineer. All shop drawings submitted shall bear the stamp of the contractor to show that they have been reviewed in detail.

F. No work shall be fabricated and no equipment ordered until the architect and engineer have returned acceptable reviewed shop drawings.

G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this section.

1.05 PROJECT SEQUENCING

A. The contractor shall refer to the architectural plans and specifications for areas of work and general schedules to determine the scope of work required during each phase of the construction.

B. All temporary valves, dampers, etc. not indicated, but required by phasing, shall be included in the base bid.

1.06 HVAC DESIGN CONDITIONS

A. Winter:

1. Outdoor: -10° F.
2. Indoor: 75° F.

B. Summer:

1. Outdoor: 96.6° F. DB and 77.6° F. WB
2. Indoor: 75° F. DB and 64° F. WB

1.07 SUBSTITUTIONS

A. The materials, products, and equipment described in these specifications or on the drawings establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. Listing of these manufacturers shall in no way be construed as a device intended to limit the bidders to those specifically listed.

B. Reference to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number, shall be interpreted as having established a standard of quality and shall not be construed as limiting competition. Articles, fixtures, etc. of equal quality by manufacturers listed in this specification for the applicable use, shall be acceptable, subject to performance, spatial, structural, and electrical constraints of the project design.

C. The Engineer reserves last opinion as to a product's equality or superiority to that specified.

1.08 DEFINITIONS

A. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

B. Install: The term "install" is used to describe operations at the project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

C. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

D. Furnished by Owner or Furnished by Others: The item will be furnished by the Owner or Others. It is to be installed and connected under the requirements of this Division, complete and ready for operation, including all items incidental to the Work, including all services necessary for proper installation and operation. The Installation shall be included under the guarantee required by this Division.

E. The design engineer, referred to as "engineer" shall mean the engineering firm, HOSS & BROWN ENGINEERS, INC., Contact person: Brandon Frey.

1.09 OPERATION AND MAINTENANCE MANUALS

A. Two (2) Flash Drives containing PDFs of Operation and Maintenance (O&M) Manuals shall be submitted as described below. Files and folder names shall be clearly labeled. Folder structure and names shall be intuitive and clearly labeled.

B. Before project close-out, submit O&M operating, maintenance instructions, and parts lists for equipment provided. Include in the manual a list of emergency service organizations capable of rendering service for each piece of equipment.

C. Keep in a safe place all keys, wrenches, and other specialty tools furnished with equipment. Present to owner at project close-out and receive a receipt showing he has received the same.

D. At the completion of the project furnish to the Architect for the Owner O&M brochures divided and tabbed, containing all data, diagrams, capacities, spare part numbers, manufacturers service and maintenance data, warranties, guarantees, etc., including local contacts and escalation schedule complete with addresses and telephone numbers, of all equipment, apparatus, and system components furnished and installed under this Division of the specifications.

1.10 CODES AND ORDINANCES

A. All work shall be in accordance with applicable codes, rules, ordinances, and regulations of local, state, and federal governments and other authorities having jurisdiction.

B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard, to any ordinances, laws, codes, rules, or regulations bearing on work, the contractor shall execute work in accordance with such without increased cost to the owner, but not until he has referred such variances to the engineer.

C. The contractors shall secure and pay for the necessary permits and certificates of inspection for their trade. Keep record of all permits and inspections and submit two copies to the engineer with request for final inspection.

1.11 OWNER TRAINING

A. Contractor shall demonstrate to the owner that all mechanical systems installed under this division of the specifications are complete and operating as intended. Contractor shall provide documentation to owner of owner training.

B. Any adjustments or other additional work required as a result of failure of any system to comply with the intent of this specification shall be accomplished at no additional cost to the Owner.

1.12 WARRANTY

A. This contractor shall warrant that the complete systems installed under this contract shall be free of defects in workmanship and materials for a period of one (1) year from the date of substantial completion by the arch/owner.

B. If defects occur during the one year guarantee period, this contractor shall repair or replace such defects at no expense to the owner and to the satisfaction of the owner and engineer.

PART 2 PRODUCTS

2.01 GENERAL

A. Where the quality of required material is not specified, the Contractor shall furnish a first class standard item as approved by the Architect/Engineer.

B. Capacities of equipment and materials shall not be less than those indicated.

C. All work performed shall provide a neat and workmanlike appearance when completed, to the satisfaction of the engineer.

D. Provide 3-1/2” concrete base for all floor mounted equipment unless shown or noted otherwise. Provide 6x6 welded wire fabric reinforcing minimum or as required by the structural engineer.

E. Adequately protect equipment from damage after delivery to the jobsite. Cover with heavy polyethylene plastic. Elevate equipment when there is danger of water damage. Equipment damaged will be rejected.

F. Any scratches to factory finishes shall be touched up using factory supplied paint before final acceptance. If extensive damage to factory finishes has occurred, equipment panels shall be replaced to the satisfaction of the engineer. If rust has formed, remove as recommended by the manufacturer prior to touch-up.

2.02 EQUAL PRODUCTS OF LISTED MANUFACTURERS

A. In general, the specifications and drawings identify required materials and equipment by naming first the manufacturer whose product was used for the basis of design. The manufacturer’s product, series, model, catalog, and/or identification numbers shall set quality, construction and dimensional requirements for comparing the other manufacturer’s products. The capacity and performance of all equipment shall meet or exceed what is indicated on the drawings and/or scheduled.

B. Where other manufacturer’s names are listed, they are considered an acceptable manufacturer for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers have been shown.

C. Where other than first named products are used, it shall be the responsibility of the contractor to determine prior to bid time that his proposed materials and equipment selections do not require adjustments in the mechanical, electrical , structural, or architectural requirements as shown on the drawings. The contractor shall include in his bid all costs associated with any required adjustments.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all equipment in strict accordance with the manufacturer's recommendations and the shop drawings reviewed by the Engineer.

B. The complete installation shall function as designed and intended with respect to efficiency, capacity, and noise level, etc. Any abnormal noise caused by rattling equipment, piping, ducts, conduit, air devices, or squeaks in rotating equipment will not be acceptable

C. Locations of equipment, piping, and other work are indicated diagrammatically on the drawings. Each contractor shall coordinate exact locations subject to structural conditions, work of other contractors, access requirements, and the approval of the architect and engineer.

D. Any item interfering with proper placement of other work shall be removed and relocated without extra cost if reasonable coordination would have eliminated the interference. Damage to other work caused by this contractor shall be restored as specified for new work.

E. Written dimensions are preferred over scaled dimensions. When written dimensions are not available, the contractor shall be responsible for determining the proper installed location.

F. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification.

G. Contractor shall perform initial start-up of systems and shall provide necessary supervision and labor to make the first seasonal change-over of systems. Owner's operating personnel shall be present during this operation.

H. It is the contractor's responsibility to provide materials and trim which properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.

I. This contractor shall provide all miscellaneous steel, etc., for the proper installation of the systems specified and/or indicated on the plans.

3.02 CONNECTIONS TO BUILDING STRUCTURE

A. Any item connecting to building structure shall be done in a manner accepted by the structural engineer.

B. When bar joists are used for steel construction, items shall be supported from angle iron spanning the top chord of the joists.

3.03 CLEANING

A. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.

3.04 EXISTING UTILITIES

A. Locate and mark all known utilities prior to proceeding with work. Proceed with caution since unmarked utilities may exist on site.

B. Should any existing utilities be damaged or disrupted, immediately notify Owner and repair to existing conditions.

C. The Contractor shall closely coordinate all utility downtime with the Owner and Architect giving a minimum fourteen (14) day notice prior to downtime.

D. Downtimes are to be held to a minimum duration with the Owner being notified as to the extent of said downtime.

End of Section 23 01 00

SECTION 23 05 13 - ELECTRICAL PROVISIONS OF HVAC WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The contractors responsible for Division 23 work shall coordinate with the Electrical Contractor to insure motor starters of the proper size are furnished. Further, the Mechanical Contractor shall furnish all electric control items indicated to the Electrical Contractor for installation and connection.

B. Refer to Section 26 01 13 - ELECTRICAL CONNECTIONS for required electrical connections.

PART 2 PRODUCTS

2.01 MOTOR STARTERS

A. The Electrical Contractor shall provide all motor starters required for equipment provided in the mechanical contract that is not integral with equipment.

PART 3 EXECUTION

3.01 MOTOR STARTERS

A. The Mechanical Contractor shall coordinate all motor starters type and size with the Electrical Contractor to insure compatibility with the motors provided in this contract.

ITEM	Furnished By	Set By	Power Wiring	Control Wiring
Equipment motors	MC	MC	EC	---
Motor control centers	EC	EC	EC	TC
Factory furnished motor starters, contactors and disconnects	MC	MC	EC	TC
Loose motor starters, disconnect switches, thermal overloads and heaters.	EC	EC	EC	TC
Manual operating multi-speed switches	MC	EC	EC	TC
Control relays and transformers	TC	TC	EC	TC
Thermostats (low voltage)	TC	TC	---	TC
Thermostats (line voltage)	MC	EC	EC	---
Temperature control panels	TC	TC	EC	TC
Automatic damper operators (low voltage)	TC	TC	---	TC
Automatic damper operators (line voltage)	MC	EC	EC	---
Factory furnished variable frequency drives	MC	MC	EC	TC
Loose variable frequency drives	EC	EC	EC	TC
Motor and solenoid operated valves, low voltage	MC	MC	TC	TC
Motor and solenoid operated valves, line voltage	MC	MC	EC	EC
Smoke dampers and combination fire / smoke dampers	MC	MC	EC	EC
Duct smoke detectors	EC	MC	EC	EC
Refrigeration equipment and controls	MC	MC	EC	TC

Pushbutton stations and connections	MC	MC	EC	TC
Interlocks between kitchen exhaust hood(s) and make-up air unit(s)	---	---	EC	EC

MC = Mechanical Contractor
TC = Temperature Control Contractor – when there is not a separate TC, all items marked thus shall be performed by the MC.
EC = Electrical Contractor

End of Section 23 05 13

SECTION 23 05 15 - HVAC RELATED WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The following is the work required by the General Contractor to facilitate the work of the Mechanical Contractor.

1. Openings and chases.

B. The following is the work required by the Mechanical Contractor to facilitate the work of his Contract.

1. Cutting and patching.
2. Excavation and backfilling.
3. Pipe sleeves.

1.02 RELATED DOCUMENTS

A. Refer to Division 31 for backfilling requirements.

B. Unless otherwise addressed in the specification, as a minimum, backfill in 6” lifts, compacting to a minimum of 90%. The first 12” of fill above any buried item outside the building shall be sand in order to contrast with other fill material. Provide a yellow warning tape at the top of the sand layer.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 GENERAL CONTRACTOR'S WORK

A. The General Contractor shall leave such openings and chases in new construction for pipes, cabinets, access doors, and equipment as may be necessary or directed by the Architect to facilitate the work of the Mechanical Contractor and to refinish around same. The Mechanical Contractor shall properly advise in due time as to the location and sizes of such openings and chases.

3.02 MECHANICAL CONTRACTOR'S WORK

A. The Mechanical Contractor shall be responsible for locating and setting his own pipe sleeves, and be well aware of the job progress to avoid unnecessary delay for setting of same.

B. The Mechanical Contractor shall be responsible for cutting his own holes in existing construction and for patching and finishing around same, unless noted otherwise, to the satisfaction of the Architect. Any holes left in walls when existing pipe is removed by this Contractor shall be patched and finished by this Contractor.

C. The Mechanical Contractor shall do all excavating and backfilling necessary to complete work under this contract. Lines shall be used to lay out the trenches for underground work. Trenches shall be of sufficient width and shall be cribbed or braced to prevent cave-in or settlement. Trenches close to walls and columns of the building shall not be excavated without the Architect's prior consent. The bottoms of trenches shall be tamped hard and graded to secure the required fall before laying pipe. Bell holes shall be excavated so the pipe will rest on solid ground for its entire length.

D. Hand backfill and tamp backfill into place at sides of pipes, leaving tops and joints exposed until pipe runs have been tested and approved.

E. All sidewalks, streets, or alley surfaces that have to be broken in connection with this contract shall be patched to the satisfaction of the Architect.

End of Section 23 05 15

SECTION 23 05 17 - FIRE STOPPING FOR HVAC SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

A. Fire stopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested fire stop systems shall be used in specific locations as follows:

1. Penetrations for the passage of duct, piping, and other Mechanical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
2. Repetitive mechanical penetrations in fire-rated floor assemblies.

1.04 REFERENCES

A. Test Requirements: ASTM E-814-02, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 (August 24, 2000) and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. The UL Fire Resistance Directory includes the following:

1. Fire stop Devices (XHJI)
2. Fire Resistance Ratings (BXUV)
3. Through-Penetration Fire stop Systems (XHEZ)
4. Fill, Voids, or Cavity Material (XHHW)
5. Forming Materials (XHKU)

C. International Fire stop Council Guidelines for Evaluating Fire stop Systems Engineering Judgments

D. Inspection Requirements: ASTM E 2174 – 01, “Standard Practice for On-site Inspection of Installed Fire Stops.”

E. ASTM E-84-01, “Standard Test Method for Surface Burning Characteristics of Building Materials.”

F. All major building codes: ICBO, SBCCI, BOCA, and IBC.

G. NFPA 101 - Life Safety Code

1.05 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of fire stop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Fire stop System installation must meet requirements of ASTM E-814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed fire stop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Fire stop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those fire stop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Fire stop Council.

1.06 SUBMITTALS

A. Submit Product Data: Manufacturer’s specifications and technical data for each material including the composition and limitations, documentation of UL fire stop systems to be used and manufacturer's UL approved installation instructions.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor’s name who will install fire stop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.07 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the fire stopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its fire stopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.09 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Scheduling

1. Schedule installation of CAST IN PLACE fire stop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
2. Schedule installation of other fire stopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of fire stop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent fire stopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Subject to compliance with through penetration fire stop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, Phone 800-879-8000
2. STI Firestop
3. 3M Fire Barrier Products.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 FIRE STOPPING, GENERAL

A. Provide fire stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the fire stopping under conditions of service and application, as demonstrated by the fire stopping manufacturer based on testing and field experience.

B. Provide components for each fire stopping system that are needed to install fill material. Use only components specified by the fire stopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.03 MATERIALS

A. Use only fire stop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place fire stop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Fire stop Device or approved equal: Add Aerator adaptor when used in conjunction with aerator (“solvent”) system.

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Fire stop Sealant or approved equal
2. Hilti CP 604 Self-leveling Fire stop Sealant or approved equal
3. Hilti CP 620 Fire Foam or approved equal
4. Hilti CP 606 Flexible Fire stop Sealant or approved equal
5. Hilti CP 601s Elastomeric Fire stop Sealant or approved equal

D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti CP 601s Elastomeric Fire stop Sealant or approved equal
2. Hilti CP 606 Flexible Fire stop Sealant or approved equal

3. Hilti FS-ONE Intumescent Fire stop Sealant or approved equal

E. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Fire stop Sealant or approved equal

F. Fire stop collar or wrap devices attached to assembly around combustible plastic pipe, the following products are acceptable:

1. Hilti CP 642 Fire stop Collar or approved equal
2. Hilti CP 643 Fire stop Collar or approved equal
3. Hilti CP 645 Wrap Strips or approved equal

G. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK or approved equal

H. Provide a fire stop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

PART 3 EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.
2. Surfaces to which fire stop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by fire stopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of fire stopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Fire stop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place fire stop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install fire stop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
2. Consult with Mechanical engineer, project manager, and damper manufacturer prior to installation of UL fire stop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROLS

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration fire stopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of fire stopping caused by cutting or penetrating of existing fire stop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess fire stop materials and soiling as work progresses.

End of Section 23 05 17

SECTION 23 05 29 - PIPING SUPPORTS, ANCHORS AND SEALS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide piping support, anchors, and seals as specified and indicated on drawings.

B. Pipe shall not pass through footings or beams without the consent of the Architect.

1.02 SUBMITTALS

A. Shop drawings of the fire-stopping method shall be approved prior to the setting of any sleeves and shall clearly define the UL fire-stopping method and required sleeve clearances.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification is B-Line Systems Inc. and shall represent the minimum level of construction. Equipment manufactured by Erico and Grinnell shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 HANGERS AND SLEEVES

A. All insulated horizontal piping shall be supported from outside the insulation. Provide inserts and saddles as recommended by the insulation manufacturer.

B. Pipe hangers for lines 1/2” to 2” shall be adjustable swivel ring hanger equal to B-Line Figure B-3170NF and B-3170CT or approved equal, for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger swivel rings. Upper ends supported as hereinafter specified with the proper B-Line or approved equal, upper attachments.

C. Pipe hangers for lines 2 1/2” to 4” shall be light duty clevis hanger equal to B-Line Figure B-3104 and B-3104CT or approved equal, for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger rod holes. Upper ends supported as hereinafter specified with the proper B-Line or approved equal, upper attachments.

D. Pipe hangers for lines 6” and larger shall be standard clevis hanger equal to B-Line figure B3100 and B3100C or approved equal, for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger rod holes. Upper ends supported as hereinafter specified with the proper B-Line or approved equal, upper attachments.

E. Provide B-Line Figure B-3373 and B-3373CT or approved equal, riser clamps for ferrous and copper piping, respectively, at each floor and at other locations where vertical support is necessary.

F. Pipe sleeves will be required in all pipe penetrations through new exterior walls, masonry walls, floors and fire rated gyp. board walls. Sleeves shall be either Schedule 5 steel pipe, field fabricated from minimum 16 gauge steel with 2" overlap at the seam, or as required by U.L. listed fire-stopping system.

G. Pipe sleeves will not be required in existing wall penetrations of masonry construction when such openings are made by "core-drilling".

PART 3 EXECUTION

3.01 PIPE SLEEVES

A. Space between sleeves and pipes in outside walls shall be filled or tightly caulked with oakum, butyl rubber, link seals or other approved equally effective material to resist the penetration of water. Pipe sleeve shall be sufficient diameter to provide approximately 1/2" clearance around pipe, and in the case of insulated pipe, approximately 1/2" around insulation.

B. Space between sleeves and pipes in other wall construction shall be diameter as required to provide the clearance required by the U.L. listed fire-stopping method chosen by the Contractor.

C. Sleeves shall be set no closer than three pipe diameters center to center, be set 3/4" past all wall surfaces, and securely anchored to the wall.

D. Sleeves in floor construction shall extend 1” above finished floor.

3.02 PIPE HANGERS

A. Upper ends of hanger rods shall be supported angle iron laid across top chord of bar joists, or from side beam clamps in steel structure.

B. Upper ends of hanger rods shall be supported as approved by the structural engineer.

C. Hanger and support spacing for horizontal steel and copper piping shall not exceed the values given in the following table:

D.

NOMINAL PIPE SIZE	STEEL PIPE	COPPER PIPE
1/2" - 1-1/4"	7'	5'
1-1/2" - 2"	9'	6'
2-1/2" - 3"	11'	10'
4"	14'	10'
6"	17'	--
8"	19'	--
10" - 12"	22'	--

E. Refrigerant liquid lines less than ½” in size shall be supported from, and secured to, the adjacent suction line by means of a clamp (taping will not be accepted)

F. No pipe hanger rod shall be less than 6" in length unless otherwise shown or approved.

G. Spacing of supports and braces for exposed vertical piping shall not exceed the hanger spacing specified for horizontal pipe, unless otherwise indicated.

H. At the contractor’s option, piping runs of multiple parallel lines may be ‘trapezed’ into a single support.

End of Section 23 05 29

SECTION 23 05 50 – TESTING AND ADJUSTING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide testing, adjusting, and balancing of the systems as specified and indicated on drawings.

B. The mechanical contractor shall procure the services of a balancing and testing agency which will balance in compliance with the National Environmental Balancing Bureau. All work by this agency shall be done under direct field supervision of a qualified testing and balancing engineer employed by them.

C. The test and balance firm shall not be the same company as the installing contractor and shall not be connected to the installing company by like ownership or similar relationship.

D. All instruments used by this agency shall be accurately calibrated and maintained in good working order. If requested, the tests shall be conducted in the presence of the Mechanical Engineer and/or their representative responsible for the project.

E. The air balance agency shall have successfully completed at least ten projects of similar size and scope and shall have been in business for a minimum of five years.

F. The following systems shall be fully tested before covering or concealing.

G. All leaks shall be repaired in a satisfactory manner by the installing contractor.

H. Air balancing shall be performed after ceilings and all duct components are in place. Doors shall be closed when performing the air balance.

I. Verify proper operation of the automatic temperature controls.

J. Piping systems shall be fully tested and/or balanced, before covering or concealing, in the presence of the Owner's representative.

1.02 ACCEPTABLE TESTING AND BALANCING FIRMS:

A. The following companies are approved to provide the testing and balancing as specified:

Total Air Balance
1945 West MacKenzies Way
Nixa, MO 65714 (417) 207-9999

Carlson and Associates
5601 S Campbell Ave
Springfield, MO 65810 (417) 887-1640

Quality Test, Adjust and Balance, Inc
18823 W 117th St. N
Sedgwick, KS 67135 (316) 796-0030

Pro Balance
5411 West 40 Hwy
Blue Springs, Mo 64015 (816) 228-7800

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 PIPING SYSTEMS, INTEGRITY TEST

A. The following piping systems shall be fully tested before covering and concealing in the presence of the Owner's representative. All leaks shall be repaired in a satisfactory manner.

1. All fittings and joints in refrigerant piping shall be tested with a halide torch or electronic tester.

B. Before final connections to equipment are made, completely flush all debris and foreign material from piping systems by circulating an approved cleaning solution.

3.02 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
3. Compare design to installed equipment and field installations.
4. Check filters for cleanliness.
5. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
6. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
7. Determine best locations in main and branch ductwork for most accurate duct traverses.
8. Place outlet dampers in the full open position.
9. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
10. Lubricate all motors and bearings.
11. Check fan belt tension.
12. Check fan rotation.

3.03 SYSTEM PERFORMANCE TESTING AND BALANCING

A. This Contractor shall procure the services of a balancing and testing agency which will balance in compliance with the National Environmental Balancing Bureau. All work by this agency shall be done under direct supervision of a qualified testing and balancing engineer employed by them. All instruments used by this agency shall be accurately calibrated and maintained in good working order. If requested, the tests shall be conducted in the presence of the mechanical engineer responsible for project and/or his representative.

B. The following testing and balancing shall be performed. Air and water flows shall be balanced to within plus or minus 10% of design requirements. Six copies of the final compilation of data shall be submitted to the Engineer for evaluation and approval.

1. Air supply, return and exhaust systems with air quantities for each air outlet or intake, fan powered VAV box minimum and maximum settings, air handling units and fan data to include CFM, static pressure, RPM, motor running and full load amperage before and after final balancing.
2. Air handling unit, duct coil, FP box and fan coil unit coils heating/cooling operational data including supply, return, mixed and outdoor air temperatures and coil inlet and leaving water temperatures and flow quantity.

C. In conjunction with the agency testing and balancing service, the mechanical contractor shall:

1. Clean ductwork, coils, fans, etc. in the air system to remove all construction dust and debris, and provide new air filters.
2. Start, lubricate and balance all fans. Change or adjust pulleys as required to give proper fan RPM.

D. Furnish complete plans, operating and maintenance manuals and shop drawings of all installed equipment, including temperature controls, to the air and water balancing agency. Upon completion of balancing and testing, the mechanical contractor shall make such additional adjustments, at the direction of the balancing agency and Engineer, as required for the systems to operate as designed.

3.04 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

End of Section 23 05 50

SECTION 23 05 53 - HVAC IDENTIFICATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide HVAC identification as specified and indicated on the drawings.

B. This Section includes the following mechanical identification materials and their installation:

1. Equipment markers
2. Access panel and door markers
3. Pipe markers
4. Duct markers
5. Valve tags
6. Valve schedules

1.02 SUBMITTALS

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

B. Valve Schedules: Provide valve numbering scheme and identification type for each piping system. Furnish extra copies (in addition to mounted copies) to include in Operation and Maintenance Manuals.

1.03 COORDINATION

A. Coordinate installation of identifying devices with completion of insulation and jacketing surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:

1. Seton
2. Brady
3. Craftmark
4. Brimar Industries, Inc.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Markers: Engraved, color-coded laminated plastic.

1. Terminology: Match schedules as closely as possible.
2. Data:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
3. Size: 2-1/2” by 4” for control devices, dampers, and valves; 4-1/2” by 6” for equipment.
4. Letter Size: Minimum 1/4 “ for name of units if viewing distance is less than 24 inches,

1/2“ for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

B. Access Panel and Door Markers: 1/16” thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8” holes for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.03 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ANSI/ASME A13.1, unless otherwise indicated.
2. Type and Size of Letters: Comply with ANSI/ASME A13.1, unless otherwise indicated.
3. Legends: Spelled out in full or commonly used and accepted abbreviations.
4. Pipes with OD, Including Insulation, Less Than 6”: Full-band pipe markers extending 360 degrees around pipe at each location.
5. Pipes with OD, Including Insulation, 6“ and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
6. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semi rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semi rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

PART 3 EXECUTION

3.01 EQUIPMENT IDENTIFICATION

A. Install equipment markers on or near each piece of mechanical equipment.

B. All equipment shall be labeled as directed by the owner or as designated on the drawings if the owner has no other preference.

C. Locate equipment markers where accessible and visible. Include markers for the following general categories of equipment:

1. Main control and operating valves including safety devices.
2. Meters, gauges, thermometers, and similar units.
3. Coils, compressors and similar equipment.
4. Fans, blowers, primary balancing dampers and mixing boxes.
5. Packaged HVAC central-station and zone-type units.
6. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

D. Install access panel markers with screws on equipment access panels.

3.02 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

B. All piping shall be labeled as directed by the owner or as designated on the drawings if the owner has no other preference.

C. Locate pipe markers where accessible and visible.

1. Pipes with OD, Including Insulation, Less Than 6”: Pretensioned pipe markers. Use size to ensure a tight fit.
2. Pipes with OD, Including Insulation, 6” and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

D. Locate pipe markers where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and locations as follows:

1. Near each valve and control device
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings and nonaccessible enclosures.
4. At access doors and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25’ along each run.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

End of Section 23 05 53

SECTION 23 07 13 –DUCT INSULATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct installation of insulation on all ductwork, fittings, valves, controls and all other items connected into the system as defined in the specifications and on the drawings.

B. Where duct systems are to be pressure tested, schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

C. All materials specified in this section shall meet UL 723, ASTM E84, and NFPA 255: maximum flame spread index of 25 and maximum smoke developed index of 50.

D. Refer to Part 3 for requirements for instruction on where insulating materials shall be applied.

1.02 WORKMANSHIP

A. Insulation shall be installed by a licensed contractor and applied in accordance with the manufacturer's instructions and recommendations.

1. All work shall comply with all applicable federal, state and local codes and laws. This shall include, but shall not be limited to, the Occupational Safety and Health Act.
2. All work shall conform to accepted industry and trade standards for commercial and industrial insulations.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for duct insulation in this specification are as listed below and shall represent the minimum level of construction. Equipment manufactured by CertainTeed, Owens-Corning, Johns-Mansville, Knauf, Fire Master, 3M, Armacell, and Aeroflex shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 GLASS-FIBER BLANKET INSULATION – TYPE 1

A. CertainTeed SoftTouch or approved equal, type 150, composed of glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290 and ASTM C1338 fungi resistance. Factory-applied FSK jacket: aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket complying with ASTM C1136 and UL listed. Adhesive materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Thickness: 1½"
2. Density: 1.5 pcf
3. Thermal Conductivity (k-Value): 0.24 at 75°F mean temperature
4. Thermal Resistance (R-value): 6.2
5. Water vapor transmission: 0.02 perms max.

B. The basis for glass-fiber blanket insulation is CertainTeed which shall represent the minimum

level of construction. Products manufactured by Owens-Corning, Johns-Mansville and Knauf shall be permitted to bid these specifications.

2.03 GLASS-FIBER BLANKET INSULATION – TYPE 2

A. CertainTeed SoftTouch, type 75, or approved equal, composed of glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290 and ASTM C1338 fungi resistance. Factory-applied FSK jacket: aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136 Type II. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket complying with ASTM C1136 and UL listed. Adhesive materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Thickness: 3"
2. Density: 0.75 pcf
3. Thermal Conductivity (k-Value): 0.31 at 75°F mean temperature
4. Thermal Resistance (R-value): 9.6
5. Water vapor transmission: 0.02 perms max.

B. The basis for glass-fiber blanket insulation is CertainTeed which shall represent the minimum level of construction. Products manufactured by Owens-Corning, Johns-Mansville and Knauf shall be permitted to bid these specifications.

2.04 GLASS-FIBER BOARD INSULATION – TYPE 3

A. CertainTeed CertaPro type CB 110, or approved equal, composed of glass fibers bonded with a thermosetting resin. Comply with ASTM C612 Type IA and ASTM C1338 fungi resistance. Factory-applied FSK jacket: aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket complying with ASTM C1136 and UL listed. Adhesive materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Thickness: 1½"
2. Density: 1.1 pcf
3. Thermal Conductivity (k-Value): 0.25 at 75°F mean temperature
4. Thermal Resistance (R-value): 6.0
5. Water vapor transmission: 0.02 perms max.

B. The basis for glass-fiber board insulation is CertainTeed which shall represent the minimum level of construction. Products manufactured by Owens-Corning, Johns-Mansville and Knauf shall be permitted to bid these specifications.

2.05 GLASS-FIBER BOARD INSULATION – TYPE 4

A. CertainTeed CertaPro type CB 300, or approved equal, composed of glass fibers bonded with a thermosetting resin. Comply with ASTM C612 Type IA and ASTM C1338 fungi resistance. Factory-applied FSK jacket: aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket complying with ASTM C1136 and UL listed. Adhesive materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Thickness: 2"
2. Density: 3.0 pcf
3. Thermal Conductivity (k-Value): 0.23 at 75°F mean temperature
4. Thermal Resistance (R-value): 8.7

5. Water vapor transmission: 0.02 perms max.

B. The basis for glass-fiber board insulation is CertainTeed which shall represent the minimum level of construction. Products manufactured by Owens-Corning, Johns-Mansville and Knauf shall be permitted to bid these specifications.

2.06 GLASS-FIBER DUCT LINER – TYPE 5

A. CertainTeed ToughGard R Duct Liner type 200, or approved equal, composed of rotary-type glass fibers bonded with a thermosetting resin and overlaid with a durable fire resistant surface on the airside. Comply with ASTM C1071 Type I, ASTM G22 bacteria resistance and ASTM C1338 fungi resistance. Adhesive materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated. Mechanical fasteners: galvanized steel pins suitable for attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct

1. Thickness: ½”
2. Density: 2.0 pcf
3. Thermal Conductivity (k-Value): 0.24 at 75°F mean temperature
4. Thermal Resistance (R-value): 2.1
5. Noise Reduction Coefficient (NRC): 0.45

B. The basis for glass-fiber duct liner is CertainTeed which shall represent the minimum level of construction. Products manufactured by Owens-Corning, Johns-Mansville and Knauf shall be permitted to bid these specifications.

2.07 GLASS-FIBER DUCT LINER – TYPE 6

A. CertainTeed ToughGard R Duct Liner type 150, or approved equal, composed of rotary-type glass fibers bonded with a thermosetting resin and overlaid with a durable fire resistant surface on the airside. Comply with ASTM C1071 Type I, ASTM G22 bacteria resistance and ASTM C1338 fungi resistance. Adhesive materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated. Mechanical fasteners: galvanized steel pins suitable for attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct

1. Thickness: 2”
2. Density: 1.5 pcf
3. Thermal Conductivity (k-Value): 0.23 at 75°F mean temperature
4. Thermal Resistance (R-value): 8.3
5. Noise Reduction Coefficient (NRC): 0.90

B. The basis for glass-fiber duct liner is CertainTeed which shall represent the minimum level of construction. Products manufactured by Owens-Corning, Johns-Mansville and Knauf shall be permitted to bid these specifications.

2.08 FIRE-RATED BLANKET INSULATION – TYPE 7

A. 3M Fire Barrier Duct Wrap 615+, or approved equal, flexible high-temperature fire-resistant wrap composed of inorganic fibers encapsulated with a scrim-reinforce foil. Comply with ASTM E2336 and ISO 6944-1985. 3M FSK Tape 3320: Foil-face, vapor-retarder tape matching factory-applied jacket. 3M Fire Barrier Sealant compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Thickness: 1 ½”
2. Density: 6.0 pcf
3. Thermal Conductivity (k-Value): 0.24 at 75°F mean temperature
4. Thermal Resistance (R-value): 6.3 at ambient temperature

B. The basis fire-rated blanket insulation is 3M which shall represent the minimum level of construction. Products manufactured by Owens-Corning, Johns-Mansville and Fire Master shall be permitted to bid these specifications.

2.09 FLEXIBLE ELASTOMERIC INSULATION – TYPE 8

A. Armacell ArmaTuff White is Armaflex closed cell, or approved equal, fiber-free elastomeric foam insulation with an exterior laminated composite layer of polymer and foil for protection against ultraviolet radiation, weather and chemicals. Comply with ASTM C534, Type II, ASTM C1338 fungi resistance and ASTM G22 bacterial resistance. Adhesive materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Thickness: 2"
2. Density: 3.0 – 6.0 pcf
3. Thermal Conductivity (k-Value): 0.27 at 75°F mean temperature
4. Thermal Resistance (R-value): 8.0
5. Water vapor permeability: 0.00 perms

B. The basis for flexible elastomeric insulation is Armacell which shall represent the minimum level of construction. Products manufactured by Aeroflex shall be permitted to bid these specifications

2.10 ALUMINUM JACKETS

A. MFM Building Products, FlexClad-400 factory fabricated self-adhering, or approved equal, sheet-type protective membrane. The outer layer is an embossed, UV resistant aluminum weathering surface with multiple layers of high-density cross-linked polymer film under and rubberized asphalt adhesive base.

1. Water vapor permeability: 0.009 perms

2.11 PVC JACKETS

A. High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C, 20 mils thick, white paintable finish, roll stock ready for shop or field cutting and forming. Provide factory fabricated fitting covers of same material, finish, and thickness as jacket

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean, dry and tightly sealed at all joints and seams.

3.02 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install multiple layers of insulation with longitudinal and end seams staggered.

C. Keep insulation materials dry during application and finishing.

D. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

E. Install insulation with least number of joints practical.

F. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic. Install insulation continuously through hangers and attachments.

G. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate.

H. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (that are not fire rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Coordinate insulation installation with the fire damper manufacturer’s UL approved installation instructions.

E. Insulation Installation at Floor Penetrations:

1. Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves. Coordinate insulation installation with the fire damper manufacturer’s UL approved installation instructions.

3.04 GLASS-FIBER INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins according to manufacturer’s instructions and recommendations.

1. Install a continuous unbroken vapor barrier for ducts and plenums with surface temperatures below ambient.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
2. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
3. Where duct is noted to be installed tight to structure, insulation shall be laid across top of duct prior to installation.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins according to manufacturer's recommendations.

1. Install a continuous unbroken vapor barrier for ducts and plenums with surface temperatures below ambient.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
2. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows.
3. Where duct is noted to be installed tight to structure, insulation shall be laid across top of duct prior to installation.
4. The top of exterior duct insulation shall be sloped to prevent 'ponding' of the water. Provide a minimum of two degrees of slope.

3.05 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous UL-listed fire rating per manufacturer's instructions and recommendations.

B. Insulate duct access panels and doors to achieve same fire rating as duct per manufacturer's instructions and recommendations.

3.06 ALUMINUM JACKETS

A. Apply aluminum jacket waterproofing membrane on all exterior ductwork where the ductwork insulation does not have an integral weatherproof membrane (e.g. ArmaTuff White). Install in accordance with manufacturer's instructions and recommendations at locations indicated in the specifications and on the drawings.

B. Ensure tops of exterior ducts have sufficient slope to eliminate ponding water.

C. Do not terminate the membrane on bottom of duct.

D. Apply minimum 3" side laps and minimum 6-inch end laps for ductwork applications.

E. Apply membrane to bottom of insulated ducts over 36 inches wide using mechanical attachment, in addition to adhesive, in accordance with manufacturer's instructions and recommendations.

3.07 PVC JACKETS

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications.

3.08 DUCT INSULATION SCHEDULE (REFER TO INSULATION TYPES IN SECTION 2 ABOVE)

A. Concealed Ducts Located Within the Building Thermal Envelope

1. Round medium pressure supply air – Type 1
2. Round low pressure supply air – Type 1
3. Round low pressure return air – None
4. Round outdoor air – Type 1
5. Round mixed air – Type 1
6. Round low pressure exhaust air – None
7. Rectangular medium pressure supply air – Type 1
8. Rectangular low pressure supply air – Type 1
9. Rectangular low pressure return air – None
10. Rectangular outdoor air – Type 1
11. Rectangular mixed air – Type 1

12. Rectangular low pressure exhaust air – None
13. Kitchen hood grease exhaust – Type 7
    a. Kitchen hood grease exhaust ducts from hood connection to exhaust fan connection, shall receive a two layer wrap of fire rated insulation
14. Outside air Plenum – Type 3
15. Return air Plenum – Type 3

B. Exposed Ducts Located Within the Building Thermal Envelope

1. Round medium pressure supply air – Type 1
2. Round low pressure supply air – Type 1
3. Round low pressure return air – None
4. Round outdoor air – Type 1
5. Round mixed air – Type 1
6. Round low pressure exhaust air – None
7. Rectangular medium pressure supply air – Type 3
8. Rectangular low pressure supply air – Type 1
9. Rectangular low pressure return air – None
10. Rectangular outdoor air – Type 3
11. Rectangular mixed air – Type 3
12. Rectangular low pressure exhaust air – None
13. Kitchen hood grease exhaust – Type 7
    a. Kitchen hood grease exhaust ducts from hood connection to exhaust fan connection, shall receive a two layer wrap of fire rated insulation
14. Outside air Plenum – Type 3
15. Return air Plenum – Type 3

C. Concealed Ducts Located Outside the Building Thermal Envelope (Unconditioned Spaces)

1. Round medium pressure supply air – Type 2
2. Round low pressure supply air – Type 2
3. Round low pressure return air – Type 2
4. Round outdoor air – None
5. Round mixed air – Type 2
6. Round low pressure exhaust air – None
7. Rectangular medium pressure supply air – Type 2
8. Rectangular low pressure supply air – Type 2
9. Rectangular low pressure return air – None
10. Rectangular outdoor air – None
11. Rectangular mixed air – Type 2
12. Rectangular low pressure exhaust air – None
13. Kitchen hood grease exhaust – Type 7
    a. Kitchen hood grease exhaust ducts from hood connection to exhaust fan connection, shall receive a two layer wrap of fire rated insulation
14. Outside air Plenum – None
15. Return air Plenum – Type 4

D. Exposed Ducts Located Outside the Building Thermal Envelope (Unconditioned Spaces)

1. Round medium pressure supply air – Type 2
2. Round low pressure supply air – Type 2
3. Round low pressure return air – Type 2
4. Round outdoor air – None
5. Round mixed air – Type 2

6. Round low pressure exhaust air – None
7. Rectangular medium pressure supply air – Type 4
8. Rectangular low pressure supply air – Type 4
9. Rectangular low pressure return air – Type 4
10. Rectangular outdoor air – None
11. Rectangular mixed air – Type 4
12. Rectangular low pressure exhaust air – None
13. Kitchen hood grease exhaust – Type 7
    a. Kitchen hood grease exhaust ducts from hood connection to exhaust fan connection, shall receive a two layer wrap of fire rated insulation
14. Outside air Plenum – None
15. Return air Plenum – Type 4

E. Ducts Located Outside the Building

1. Round supply air – Type 8
2. Round return air – Type 8
3. Round exhaust air – None
4. Rectangular supply air – Type 8
5. Rectangular return air – Type 8
6. Rectangular exhaust air – None

F. Acoustically Lined Ducts

1. The requirement for acoustical insulation is in addition to the thermal insulation requirement. Provide external thermal insulation and internal acoustical liner as indicated.
2. Rectangular supply air at central units – Type 5
    a. The vertical ductwork from the unit discharge to horizontal and the first 10 feet of horizontal ductwork in all directions (typical for central AHU, RTU, MAU, DOAU, etc.)
3. Rectangular supply air at fan terminal units – Type 5
    a. The first 10 feet of ductwork from the fan terminal outlet
4. Rectangular return air at central units – Type 5
    a. The vertical ductwork from the unit inlet to horizontal and the first 10 feet of horizontal ductwork in all directions (typical for central AHU, RTU, MAU, DOAU, etc.)
5. Rectangular exhaust air – Type 5
    a. The first 10 feet of ductwork from the exhaust fan inlet
6. Rectangular return air boots – Type 5
7. Rectangular transfer air ducts – Type 5.

End of Section 23 07 13

SECTION 23 07 19 – HVAC PIPING INSULATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct installation of insulation on all piping, fittings, valves, controls and all other items connected into the system as defined in the specifications and on the drawings.

B. All materials specified in this section shall meet UL 723, ASTM E84, and NFPA 255: maximum flame spread index of 25 and maximum smoke developed index of 50.

C. Refer to Part 3 for requirements for insulation thickness and instruction on where insulating materials shall be applied.

1.02 WORKMANSHIP

A. Insulation shall be installed by a licensed contractor and applied in accordance with the manufacturer's instructions and recommendations.

1. All work shall comply with all applicable federal, state and local codes and laws. This shall include, but shall not be limited to, the Occupational Safety and Health Act.
2. All work shall conform to accepted industry and trade standards for commercial and industrial insulations.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for HVAC piping insulation in this specification are as listed below and shall represent the minimum level of construction. Equipment manufactured by Johns-Mansville, Owens-Corning, Knauf, Armacell, and Aeroflex shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 FIBER GLASS PIPE INSULATION

A. Johns-Manville Micro-Lok, or approved equal, preformed fiber glass pipe insulation, complying with ASTM C 547, Type 1, rigid molded pipe insulation, noncombustible. Factory-applied ASJ vapor retarder jacket: a white, kraft paper, reinforced with a glass fiber yarn and bonded to an aluminum foil, complying with ASTM C1136 Type I, with self-sealing longitudinal closure laps and butt strips. Adhesive materials and tapes shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Thermal Conductivity (k-Value): 0.23 at 75°F mean temperature
2. Water vapor transmission: 0.02 perms max
3. Maximum Service Temperature: 850°F

B. All fittings, valves, tees, flanges, connections, etc. shall be insulated and covered with the appropriate PVC insulated fitting covers. Fitting covers shall match PVC Jackets, refer to specification below.

C. The basis for fiber glass pipe insulation and fitting covers is Johns-Manville which shall represent the minimum level of construction. Products manufactured by Owens-Corning and Knauf shall be permitted to bid these specifications.

2.03 FLEXIBLE ELASTOMERIC PIPE INSULATION

A. Armacell AP/Armaflex SS, or approved equal, fiber-free elastomeric foam insulation with self-sealing seams. Comply with ASTM C534, Type 1, ASTM C1338 fungi resistance and ASTM G22 bacterial resistance. Adhesive materials and tapes shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Density: 3.0 – 6.0 pcf
2. Thermal Conductivity (k-Value): 0.25 at 75°F mean temperature
3. Water vapor permeability: 0.05 perm-in
4. Maximum Service Temperature: 180°F (continuous exposure)

B. All fittings, valves, tees, flanges, connections, etc. shall be insulated and covered with the Armacell factory-fabricated insulation fittings. Provide Armafix pre-insulated pipe hanger fittings at all hanger locations.

C. The basis for flexible elastomeric insulation is Armacell which shall represent the minimum level of construction. Products manufactured by Aeroflex shall be permitted to bid these specifications

2.04 PAINTABLE UV RESISTANT INSULATION COATING

A. Armaflex WB or approved equal, finish UV resistant coating or equivalent for flexible elastomeric pipe insulation.

2.05 PVC JACKETS

A. High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C, 30 mils thick, white paintable finish, roll stock ready for shop or field cutting and forming. Provide factory fabricated fitting covers of same material, finish, and thickness as jacket. Adhesive materials and tapes shall be compatible with insulation materials, jackets, and substrates and for bonding jacket to itself and to insulation.

2.06 ALUMINUM JACKETS

A. Aluminum 0.016" thick sheet complying with ASTM B 209, embossed finish, with longitudinal slip joints and 2" laps, die-shaped fitting covers with factory-attached protective liner. Adhesive materials and tapes shall be compatible with insulation materials, jackets, and substrates and for bonding jacket to itself and to insulation.

2.07 INSULATED PIPE SUPPORTS

A. 360° pre-molded insulated pipe supports providing a continuous section of insulation with vapor barrier and galvanized steel shield. The insulation and vapor barrier shall extend beyond the shield for vapor tight joint with the adjoining insulation. Insulation shall be water-repellent treated calcium silicate meeting the requirements of ASTM C533 with vapor barrier jacket.

1. Minimum Compressive Strength:
   a. 100 psig for pipe sizes smaller than 6”
   b. 450 psig for pipe sizes 6” and larger

2.08 INSULATION SHIELDS

A. 180°, 20 gauge, galvanized metal shields pre-formed to fit the insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry and ducts are tightly sealed at all joints and seams.

3.02 COMMON INSULATION INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of pipes and fittings.

B. Keep insulation materials dry during application and finishing.

C. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

D. Install insulation with least number of joints practical.

E. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic and/or tape. Install insulation continuously through hangers and attachments.

F. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate.

G. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (that are not fire rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Coordinate insulation installation with the fire stopping material manufacturer’s UL approved installation instructions.

E. Insulation Installation at Floor Penetrations: Install insulation continuously through floor penetrations that are not fire rated. Coordinate insulation installation with the fire stopping material manufacturer’s UL approved installation instructions.

3.04 FLEXIBLE ELASTOMERIC PIPE INSULATION

1. Seal longitudinal seams and end joints with the manufacturer's recommended adhesive to

eliminate openings in insulation that allow passage of air to surface being insulated.

2. Insulation Installation on Pipe Fittings and Elbows:
   a. Insulate pipe fittings using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Insulation Installation on Valves and Pipe Specialties:
   a. Install preformed valve covers manufactured of same material as pipe insulation when available.
   b. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   c. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
4. Apply UV resistant insulation coating on all exterior flexible elastomeric piping insulation. Apply in accordance with manufacturer's instructions and recommendations.

3.05 PVC JACKETS

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with the manufacturer's recommended adhesive.

3.06 ALUMINUM JACKETS

A. Apply aluminum jacket waterproofing membrane on all exterior piping. Install in accordance with manufacturer's instructions and recommendations at locations indicated in the specifications and on the drawings.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by jacket manufacturer.

3.07 INSULATED PIPE SUPPORTS

A. 360° pre-molded insulation pipe supports shall be installed on piping 1 ½" and larger at hangers. Pipe insert thickness shall be equal to the adjoining insulation thickness. The length of supports shall be as follows:

Pipe Size	**Insulation Insert Length**	**Shield Length**	**Shield Gauge**
1 ½" to 5"	6"	4"	20 ga.
6" to 8"	9"	6"	16 ga.
10" to 12"	9"	6"	14 ga.
14" and larger	12"	10"	12 ga.

3.08 INSULATION SHIELDS

A. 6" long insulation shields shall be applied between hangers or supports and the pipe insulation insert for all insulated piping less than 1 ½" in diameter.

3.09 FLEXIBLE ELASTOMERIC PIPE INSULATION THICKNESS:

A. Insulate all cooling coil condensate drain lines with ½" flexible elastomeric pipe insulation.

B. Insulate all refrigerant suction lines with ¾" flexible elastomeric pipe insulation.

End of Section 23 07 19

SECTION 23 23 00 – REFRIGERANT PIPING AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the refrigerant pipe and fittings as specified and indicated on the drawings.

1.02 QUALITY ASSURANCE

A. Soldering and Brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.

PART 2 PRODUCTS

2.01 ABOVE GRADE PIPING AND FITTINGS

A. Refrigeration piping shall be Type L ACR hard copper with silfos joints. All elbow fittings, except suction line oil traps, shall be long radius type. Suction line oil traps shall be comprised of short radius elbows to minimize the quantity of oil retained.

PART 3 EXECUTION

3.01 REFRIGERANT PIPING

A. Refrigerant pipe sizing and routing indicated on the drawings is schematic and intended to document the preferred pipe routing. **The equipment manufacturer and installing contractor shall size the refrigerant lines based on the final field routing, elevation changes, and condenser locations. Detailed piping schematic and line sizing information shall be provided with the initial shop drawing submittal and confirmed in the field. All field deviations from the piping diagram and sizing criteria shall be documented and submitted by the installing contractor and manufacturer to the Engineer for review.**

A. All refrigerant lines shall be clean and provided with suction line oil traps as recommended by the manufacturer so as to assure proper oil return to the compressor.

C. All refrigerant lines shall be charged with nitrogen during all sweating and heating operations.

D. All refrigerant systems shall be evacuated with a vacuum pump prior to charging.

3.02 EXPOSED AND CONCEALED PIPING

A. All piping shall be concealed in walls, below floors, or above ceilings unless indicated otherwise or shown running through areas with exposed structure. All pipe shall be installed parallel or perpendicular to building surfaces.

End of Section 23 23 00

SECTION 23 31 13 – METAL DUCTS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all sheet metal work for supply, return, outside air, pressure relief and exhaust air systems as specified, indicated on the drawings and as required by applicable codes.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" - Third Edition 2005 and performance requirements and design criteria indicated on the drawings and in these specifications.

B. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.03 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives
2. Sealants and gaskets
3. Seismic-restraint devices

B. Shop Drawings:

1. Materials, fabrication, assembly and installation; including plans, elevations, sections, details, components and attachments to other work
2. Factory and shop-fabricated ducts and fittings
3. Duct layout indicating sizes, configuration, dimensions from building lines, elevation of top of duct, liner material and static-pressure classes
4. Sheet metal thicknesses
5. Reinforcement details and spacing
6. Joint and seam construction and sealing
7. Penetrations through fire-rated and other partitions
8. Equipment installation details specific to this project
9. Location of duct accessories including dampers, turning vanes and access doors/panels

1.04 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for metal ducts in this specification area as listed below and shall represent the minimum level of construction. Equipment manufactured by Johns-Manville, Owens-Corning, Knauf, Armacell, Aeroflex, Aerofoam USA, and Truebro shall be permitted to bid these

specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 SINGLE WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Chapter 2, Rectangular Duct Construction.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricated joint systems as manufactured by:
   a. Duct Mate
   b. Quickduc
   c. Nexus
   d. Ward
2. Shop constructed joints:
   a. Engle TDF
   b. Lockformer TDC
3. Transverse Joints in Ducts Larger than 60 Inches in Diameter shall be flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Grooved seam
2. Pittsburg lock seam.

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Rectangular branch take-offs shall be of the 45º entry design. Provide manual dampers in take-offs in low pressure ductwork.

E. Provide additional reinforcing where necessary to eliminate excessive movement and/or vibration.

2.03 DOUBLE WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Chapter 2, Rectangular Duct Construction and Chapter 8, Double Wall Duct Construction.

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

1. Lindab Inc.

2. McGill Airflow LLC.
3. Semco Incorporated
4. Sheet Metal Connectors, Inc.
5. Wesco

C. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

D. Fabricate ducts with indicated dimensions for the inner duct (inside clear dimension).

E. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger than 60 Inches in Diameter shall be flanged.

F. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

G. Interstitial Insulation: Fibrous-glass liner complying with NFPA 90A.

1. Maximum Thermal Conductivity: 0.27 Btu in./h sq. ft. deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.

2.04 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Chapter 3 Round, Oval and Flexible Duct.

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

1. Lindab Inc.
2. McGill Airflow LLC.
3. Semco Incorporated
4. Sheet Metal Connectors, Inc.
5. Wesco

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, " Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Medium pressure systems positive/negative 4” W.G. shall be spiral lock seam duct.
2. Low pressure systems positive/negative 2” W.G. may use snap lock duct.

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, " Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals,

and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Low pressure systems (positive/negative 2” W.G.) and 10 inch diameter and smaller may use snaplock seams.
2. Low pressure systems (positive/negative 2” W.G.) and 12 inch diameter and larger shall be spiral lock seam.
3. Medium pressure systems (positive/negative 4” W.G.) shall be spiral lock seam.
4. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
5. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

F. Tees and Laterals: Fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Round branch take-offs or taps shall be of the conical or 45 degree ‘wye’ design with sealer and mechanical fasteners used at tap connection.

2.05 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Chapter 3 Round, Oval and Flexible Duct and Chapter 8, Double Wall Duct Construction.

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

1. Lindab Inc.
2. McGill Airflow LLC.
3. Semco Incorporated
4. Sheet Metal Connectors, Inc.
5. Wesco

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension). Fabricate ducts with indicated dimensions for the inner duct (inside clear dimension).

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, " Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. All systems shall be spiral lock seam.
2. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
3. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Round branch take-offs or taps shall be of the conical or 45 degree ‘wye’ design with

sealer and mechanical fasteners used at tap connection.

F. Interstitial Insulation: Fibrous-glass liner complying with NFPA 90A.

1. Maximum Thermal Conductivity: 0.27 Btu in./h sq. ft. deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.

2.06 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M

1. Galvanized Coating Designation: G90
2. Finishes for Surfaces Exposed to View: Mill phosphatized
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316; cold rolled, annealed, sheet.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.07 DUCT LINER

A. Fibrous-Glass Duct Liner – Type 1: Comply with ASTM C 1071, NFPA 90A or NFPA 90B, ASTM G22 bacteria resistance, ASTM C1338 fungi resistance and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed ToughGuard R Duct Liner Type 200 or comparable product by one of the following:
   a. Johns Manville
   b. Knauf Insulation
   c. Owens Corning
2. Thickness: ½”
3. Density: 2.0 pcf
4. Maximum Thermal Conductivity: 0.24 at 75 degrees F mean temperature
5. Thermal Resistance (R-value): 2.1
6. Noise Reduction Coefficient (NRC): 0.45

B. Fibrous-Glass Duct Liner – Type 2: Comply with ASTM C 1071, NFPA 90A or NFPA 90B, ASTM G22 bacteria resistance, ASTM C1338 fungi resistance and with NAIMA AH124,

"Fibrous Glass Duct Liner Standard."

1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed ToughGuard R Duct Liner Type 150 or comparable product by one of the following:
   a. Johns Manville
   b. Knauf Insulation
   c. Owens Corning
2. Thickness: 2”
3. Density: 1.5 pcf
4. Maximum Thermal Conductivity: 0.24 at 75 degrees F mean temperature
5. Thermal Resistance (R-value): 6.3
6. Noise Reduction Coefficient (NRC): 0.8

2.08 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches or 4 inches
3. Sealant: Modified styrene acrylic
4. Water, mold and mildew resistant
5. Maximum Static-Pressure Class: 10-inch wg, positive and negative
6. Service: Indoor and outdoor
7. Service Temperature: 0 to 200 degree F
8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on
2. Solids Content: Minimum 65 percent
3. Shore A Hardness: Minimum 20
4. Water, mold and mildew resistant
5. VOC: Maximum 75 g/L (less water)
6. Maximum Static-Pressure Class: 10 inch W.G., positive and negative
7. Service: Indoor or outdoor
8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel or aluminum.

D. Flange Gaskets: Butyl rubber, neoprene or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.09 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Cables for Galvanized-Steel and Aluminum Ducts: Galvanized steel complying with ASTM A 603.

E. Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate

PART 3 EXECUTION

3.01 DUCTWORK INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Coordinate duct system installation with all other trades. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated. This Contractor shall keep on the project at all times a set of SMACNA Standards. Before starting any construction of sheet metal work, the Contractor shall review applicable sections.

C. Install round and flat-oval ducts in maximum practical lengths. Install all ducts with the fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally and parallel/perpendicular to building lines.

F. Protect duct interiors from moisture, construction debris, dust and other foreign materials. Comply with the “Advanced Level” of duct cleanliness as defined in SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched or damaged.

B. Provide ducts exposed in finished spaces with a paintable finish where it is indicated to be painted on the architectural plans.

C. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead.

D. Grind welds to provide smooth surface free of burrs, sharp edges and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds

and treat the welds to remove discoloration caused by welding.

E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

F. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports. Provide paintable finish for hangers of ducts noted to be painted.

E. Support vertical ducts with steel angles or channels secured to the sides of the duct with welds, bolts, sheet metal screws or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 PAINTING

A. Provide ductwork, hangers and accessories with a paintable finish where it is indicated to be exposed and painted on the architectural plans.

B. All scratches or marks occurring in PVC coated ductwork shall be coated with two coats of PVC touch-up paint.

3.07 FIELD QUALITY CONTROL

A. Perform tests and inspections

B. Duct System Cleanliness Tests:

1. Visually inspect duct systems to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner/Engineer, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
   a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
3. Duct systems will be considered defective if they do not pass tests and inspections and shall be re-cleaned until they pass. Prepare test and inspection reports.

3.08 DUCT SCHEDULE.

A. Supply Ducts

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units
   a. Galvanized sheet steel
   b. Pressure Class: Positive 1-inch wg
   c. Minimum SMACNA Seal Class: C
   d. SMACNA Leakage Class for Rectangular: 24
   e. SMACNA Leakage Class for Round and Flat Oval: 12
2. Ducts Connected to Constant-Volume Air-Handling Units or Single-Zone Variable-Volume Air Handling Units
   a. Galvanized sheet steel
   b. Pressure Class: Positive 2-inch wg
   c. Minimum SMACNA Seal Class: B
   d. SMACNA Leakage Class for Rectangular: 12
   e. SMACNA Leakage Class for Round and Flat Oval: 6
3. Ducts Connected to Variable-Air-Volume Air-Handling Units (with Terminal Units)
   a. Galvanized sheet steel
   b. Pressure Class: Positive 3-inch wg
   c. Minimum SMACNA Seal Class: B
   d. SMACNA Leakage Class for Rectangular: 12
   e. SMACNA Leakage Class for Round and Flat Oval: 6
4. Ducts Connected to Variable-Air-Volume Air-Handling Units (with Terminal Units)
   a. Galvanized sheet steel
   b. Pressure Class: Positive 4-inch wg
   c. Minimum SMACNA Seal Class: A
   d. SMACNA Leakage Class for Rectangular: 6
   e. SMACNA Leakage Class for Round and Flat Oval: 3

B. Return Ducts

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units
   a. Galvanized sheet steel
   b. Pressure Class: Negative 1-inch wg
   c. Minimum SMACNA Seal Class: C
   d. SMACNA Leakage Class for Rectangular: 24
   e. SMACNA Leakage Class for Round and Flat Oval: 12
2. Ducts Connected to Air-Handling Units:
   a. Galvanized sheet steel
   b. Pressure Class: Negative 2-inch wg
   c. Minimum SMACNA Seal Class: B
   d. SMACNA Leakage Class for Rectangular: 12
   e. SMACNA Leakage Class for Round and Flat Oval: 6

C. Exhaust Ducts

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
   a. Galvanized sheet steel
   b. Pressure Class: Negative 1-inch wg
   c. Minimum SMACNA Seal Class: C
   d. SMACNA Leakage Class for Rectangular: 24
   e. SMACNA Leakage Class for Round and Flat Oval: 12
2. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
   a. Galvanized sheet steel
   b. Pressure Class: Negative 2-inch wg
   c. Minimum SMACNA Seal Class: B
   d. SMACNA Leakage Class for Rectangular: 12
   e. SMACNA Leakage Class for Round and Flat Oval: 6
3. Ducts Connected to Air-Handling Units:
   a. Galvanized sheet steel
   b. Pressure Class: Negative 2-inch wg
   c. Minimum SMACNA Seal Class: B
   d. SMACNA Leakage Class for Rectangular: 12
   e. SMACNA Leakage Class for Round and Flat Oval: 6

D. Outdoor-Air (Not Filtered, Heated or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units
   a. Galvanized sheet steel
   b. Pressure Class: Positive or negative 1-inch wg
   c. Minimum SMACNA Seal Class: C
   d. SMACNA Leakage Class for Rectangular: 24
   e. SMACNA Leakage Class for Round and Flat Oval: 12
2. Ducts Connected to Air Handling Units
   a. Galvanized sheet steel
   b. Pressure Class: Positive or negative 2-inch wg
   c. Minimum SMACNA Seal Class: B
   d. SMACNA Leakage Class for Rectangular: 12
   e. SMACNA Leakage Class for Round and Flat Oval: 6
3. Ducts Connected to Air Handling Units
   a. Galvanized sheet steel
   b. Pressure Class: Positive or negative 3-inch wg
   c. Minimum SMACNA Seal Class: B
   d. SMACNA Leakage Class for Rectangular: 12
   e. SMACNA Leakage Class for Round and Flat Oval: 6

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts:
   a. Exposed to Airstream: Match duct material
   b. Not Exposed to Airstream: Galvanized
2. PVC-Coated Ducts:
   a. Exposed to Airstream: Match duct material
   b. Not Exposed to Airstream: Match duct material
3. Stainless-Steel Ducts:
   a. Exposed to Airstream: Match duct material
   b. Not Exposed to Airstream: Match duct material
4. Aluminum Ducts:

a. Exposed to Airstream: Match duct material
b. Not Exposed to Airstream: Match duct material

F. Elbow Configuration

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Radius Type RE 1: Minimum centerline radius equal 1.5 times the duct width
   b. Mitered Type RE 2: With vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3 - "Vanes and Vane Runners," and Figure 2-4 - "Vane Support in Elbows."
2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      - Radius-to Diameter Ratio: 1.5
   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped
   c. Round Elbows, 14 Inches and Larger in Diameter: Segmented Standing seam or Welded

G. Branch Configuration

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
   a. Rectangular Main to Rectangular Branch: 45-degree entry
   b. Rectangular Main to Round Branch: 45-degree entry (HETO High Efficiency Take Off)
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees."
   a. 45-degree lateral tap
   b. 90-degree tee with oval to round tap
   c. Saddle taps are permitted only in existing duct

H. Offsets and Transitions

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-7, "Offsets and Transitions."
   a. Change in size: Not more than 15 degrees

End of Section 23 31 13

SECTION 23 33 00 - DUCT ACCESSORIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide duct accessories as specified and as indicated on the drawings.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification are those listed and shall represent the minimum level of construction. Equipment manufactured by Greenheck, Ruskin, Prefco, Penn, Cesco, and Ventlok shall be permitted to bid these specification.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 TURNING VANES

A. Provide double vane style turning vanes in all elbows of rectangular ducts.

B. Vanes shall conform to SMACNA low velocity duct standards for small double vane construction. Vanes shall be held in place by manufactured vane rails yielding maximum 2-1/8" vane spacing.

2.03 BALANCING DAMPERS

A. Provide manual balancing damper where indicated on the plans and as required by the test and balance contractor.

B. Manual balancing dampers shall be Ruskin MD35 or approved equal, with 5" x 1" x 16 gauge galvanized steel channel frame, 16 gauge galvanized steel blades, steel shafts and molded synthetic shaft bearings. Linkage shall be arranged for opposed blade operation and shall be furnished with locking hand quadrant.

C. Dampers in round ducts shall be Ruskin MDRS25 or approved equal, single blade with 20 gauge frame and 20 gauge blade.

D. Dampers at takeoffs from rectangular trunk duct shall be as specified in the sheet metal section.

2.04 CONTROL DAMPERS

A. Provide automatic control dampers where indicated on the plans.

B. Provide all automatic control dampers, except for any specified to be provided under the individual HVAC unit specifications, or under the TEMPERATURE CONTROL SECTION.

1. Dampers shall be Ruskin CD-35 or approved equal, with 2" x 1" x 18" steel channel frame, 16 gauge steel blades, Oilite bronze bearings, cadmium plated shafts and blade and jamb seals.
2. Outside air dampers and relief air dampers shall be Ruskin CD-50 or approved equal, with extruded aluminum, low leakage damper, opposed blade design, with nylon bearings and blade and frame seals on all mating surfaces; damper leakage shall not exceed 6 CFM per square foot at 4.0" water column, tested in accordance with AMCA Standard 500.

C. Install dampers specified to be furnished under the Temperature Control Section of the Specifications as directed by the Controls Company.

2.05 GRAVITY RELIEF DAMPERS

A. Gravity relief dampers shall be Ruskin CBD6 or approved equal, with 2-1/4" x 7/8" x 1/8" aluminum channel frame and 0.070" aluminum blades with extruded vinyl edge seals and Oilite shaft bearings. Blades shall incorporate an adjustable counterbalance and shall be suitable for horizontal or vertical mounting.

B. Backdraft dampers shall be Ruskin BD6 or approved equal, with 2-1/4" x 7/8" x 1/8" aluminum channel frame and 0.070" aluminum blades with extruded vinyl edge seals and Oilite shaft bearings.

2.06 FIRE DAMPERS

A. Fire dampers installed in construction rated 2 hours or less shall be Ruskin IBD or approved equal, UL listed, folding blade type horizontal and vertical mount, with integral 14 gauge sleeve, 18 gauge steel damper blades, stainless steel spring operator (horizontal mount) and UL fusible link.

B. Mount all dampers in accordance with their listing, with the SMACNA Fire Damper and Heat Stop Guide and where required by governing fire codes.

C. Fire dampers in medium and high pressure ductwork shall have the folded blades completely out of the airstream. Fire dampers in low pressure ductwork may have the folded blades in the airstream.

D. Fire dampers installed in construction rated 3 hours or more shall be equal to a Ruskin IBD-23, or approved equal, UL labeled, folding blade type, vertical mount, with integral 4-1/2" channel frame, and UL listed fusible doors where indicated and/or required by governing fire codes or regulations.

2.07 COMBINATION FIRE/SMOKE DAMPERS

A. Combination square or rectangular smoke and fire dampers shall be equal to Ruskin FSD60 or FSD60-LP (where applicable), or approved equal, UL 555S classified smoke damper of leakage Class I at 350ºF, and UL classified multi-blade fire damper with auxiliary operating shaft. Motor operators shall be 120 volt stall type for operation as coordinated with the fire alarm manufacturer and furnished by the damper manufacturer. Dampers shall be UL classified static multi-blade fire damper and shall be rated for 3000 fpm velocity level and 4 in water gauge pressure level as required by UL classification specific to this application. Provide dampers with factory mounted test switch.

B. Combination round smoke and fire dampers shall be equal to Ruskin FSDR25, or approved equal, UL 555S classified smoke damper of leakage Class I at 350ºF, and UL classified multi-blade fire damper with auxiliary operating shaft. Motor operators shall be 120 volt stall type for operation as coordinated with the fire alarm manufacturer and furnished by the damper manufacturer. Dampers shall be UL classified static multi-blade fire damper and shall be rated for 3000 fpm velocity level and 4 in water gauge pressure level as required by UL classification specific to this application. Provide dampers with factory mounted test switch.

2.08 SMOKE DAMPERS

A. Square or rectangular smoke dampers shall be equal to Ruskin SD 60 or approved equal, UL 555S classified damper. Damper shall meet the UL 555S requirements of leakage Class I at 250ºF. Motor operator actuated by smoke detectors and/or fire alarm system, as indicated. Motor operators shall be 120 volt stall type for operation as coordinated with the fire alarm manufacturer and furnished by the damper manufacturer. Dampers shall be UL classified static multi-blade fire damper and shall be rated for 3000 fpm velocity level and 4 in water gauge pressure level as required by UL classification specific to this application. Provide dampers with factory mounted

test switch.

B. Round smoke dampers shall be equal to Ruskin SDRS25 or approved equal, UL 555S classified damper. Damper shall meet the UL 555S requirements of leakage Class I at 250ºF. Motor operator actuated by smoke detectors and/or fire alarm system, as indicated. Motor operators shall be 120 volt stall type for operation as coordinated with the fire alarm manufacturer and furnished by the damper manufacturer. Dampers shall be UL classified static multi-blade fire damper and shall be rated for 3000 fpm velocity level and 4 in water gauge pressure level as required by UL classification specific to this application. Provide dampers with factory mounted test switch.

2.09 Ceiling Diffuser Fire Protection

A. Diffusers so indicated shall be provided with Prefco 5610/5680 fire damper or approved equal with ceramic blanket for UL classified lay in diffuser installation.

B. Integral fire dampers supplied with the diffusers are acceptable.

2.10 ACCESS DOORS

A. Hinged access doors shall be installed in housings where shown and where required for access to equipment. Insulated doors shall be installed in insulated or lined housings. Access doors construction, hardware, etc. shall be as detailed in SMACNA, HVAC Duct Construction Standards, 1985, Figure 6-12.

B. Access doors shall be installed in ductwork where shown and where required for access to fire dampers, smoke damper, etc. Insulated access doors shall be used where installed in insulated or lined ductwork. Ductwork access doors shall be constructed to the pressure rating of the ductwork in which the access door is installed. Access doors shall be constructed per SMACNA Duct Construction Standards, 1985, Figure 2-12 using type 1 or type 2 locks only. Screwed access panels are not acceptable.

2.11 GREASE DUCT ACCESS DOORS

A. Grease duct access doors shall be UL listed and labeled for installation in grease duct and shall meet the requirements of NFPA 96. Grease duct access doors shall be a complete manufactured assembly.

2.12 CONCEALED DAMPER AND OPERATORS

A. Where noted and/or scheduled, provide Ruskin model ZPD-25 or approved equal electronic pulse balancing damper. Installation shall include damper, optional diffuser mounted control cable with RJ11 connector and 20 feet of connector cable.

B. Provide one Ruskin ZRC020 or approved equal hand held remote damper controller for the building. This controller is used to power the damper, adjust the damper and is not required to remain in place upon completion of test and balance work.

2.11 AIR FLOW MONITORING AND CONTROL STATIONS

A. Provide Air Monitor Control, or approved equal, air flow measuring stations complete with micro-processor transmitter controller.

B. Air flow measuring stations for Air Handling Units shall be FAN-Evaluator, or approved equal installed in rectangular ducts and capable of continuously monitoring the fan or duct air volumes as indicated. Each air flow station shall contain multiple total and static pressure sensors positioned in a log-Tehebycheff pattern. The air flow station shall be fabricated of 14 gauge galvanized steel, welded casing in 8” depth, with 90 degree connecting flanges in a configuration and size equal to the duct to be mounted in. Each station shall be complete with an open parallel cell air straightener-equalizer honeycomb mechanically fastened to the casing, and external signal

connection fittings. Station shall be AMCA certified and be capable of measuring the airflow rates within +/-2%. The maximum pressure drop of the station shall not exceed .0.085" W.C. at 2000 fpm or 0.30" W.C. at 4000 fpm.

C. Air flow monitoring stations for Exhaust Fans shall be VOLU-probe/FI, or approved equal, installed in the fan inlet and capable of continuously measuring the fan air volumes as indicated. The fan inlet airflow traverse probes shall contain multiple total and static pressure sensors placed at concentric area centers along the exterior surface of the cylindrical probes and internally connected the their respective averaging manifolds. The fan inlet airflow traverse probes shall have symmetrical averaging signal takeoffs, and shall be of aluminum construction with anodized finish and galvanized steel mounting hardware. The fan inlet airflow traverse probes shall not significantly impact the fan performance. The probes shall be capable of producing a steady, non-pulsating signal of total and static pressures without the need for flow correction factors. The station shall provide an accuracy of 3% with a 6 to 1 turndown ratio.

D. The transmitter-controllers shall be VEL-trol II, or approved equal, and capable of receiving flow signals from an airflow station or probe array and produce on output linear and scaled for air volume, velocity, or differential pressure. The three mode controller shall be capable of controlling at a user selectable internal or external setpoint, and output of 0-5vdc, 0-10vdc, or 4-20ma control signal. The transmitter shall contain an integral multi-line digital display for use during the configuration and calibration process, and to display one transmitter output plus controller setpoint during normal operating mode. All transmitter configuration, parameter setting, zero and span calibration, plus display formatting and scaling will be performed digitally in the on-board microprocessor via input push buttons. The controller will be available in multiple spans ranging from 0.05" W.C. to 10.0" W.C. with an accuracy of 0.10% of the natural span. The transmitter shall be furnished with a transducer automatic zeroing circuit and be capable of maintaining linear output signals with a 10 to 1 turndown ratio. Provide with optional 120 volt input complete with 24 VAC step down transformer.

E. Air volume measuring stations for existing terminal units (or round duct applications) shall be Aluminum LO-flo, or approved equal, Pitot Traverse Station. Each flow traverse station shall contain a flow straightener-equalizer consisting of open cell aluminum honeycomb having a minimum cell size to length ratio of 8 to 1 to minimize the effects of turbulent and rotational flows. The Pitot total pressure sensors shall be positioned at the centers of equal concentric areas on the averaging probe; the static pressure sensor will be a bullet nose type probe. The station's casing shall be of all welded construction using 3000 series aluminum. The traverse station shall be capable of measuring airflow volumes within 2% of actual flow.

2.12 CONSTANT VOLUME REGULATORS

A. Circular volume flow controllers for constant volume system shall be TROX, or equal, mechanical system powered designed for both supply and exhaust applications. Controllers shall consist of a casing with control damper blade shaft mounted and supported on bearing with a bellows and an external cam plate with leaf spring. The standard construction of the controller is provided with a set reference flow rate. The flow rate shall be set on the side of the unit by the customer in the field.

B. Flow Regulators shall be as follows:

1. CVR-1 shall be RN-250, or approved equal, rated for 600 cfm exhaust flow rate
2. CVR-2 shall be RN-250, or approved equal, rated for 750 cfm exhaust flow rate

PART 3 EXECUTION

3.01 INSTALLATION

A. All fire dampers, smoke dampers and combination fire/smoke dampers shall be installed in accordance with the manufacturer's installation instructions and in compliance with UL listing information.

B. Grease duct access doors shall be installed in accordance with the manufacturer's installation instructions and in compliance with UL listing information. Where installed in fire wrapped ductwork, the fire wrap shall be installed at the access door per the access door manufacturer's instructions so that access is not interfered with and the fire rating of the duct is maintained.

C. Access doors for fire and or smoke dampers shall be permanently identified on the exterior by a label having letters not less than 0.5 inch in height reading:

FIRE/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER

End of Section 23 33 00

SECTION 23 34 16- AIR DISTRIBUTION EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide air distribution equipment as specified and as indicated on the drawings.

1.02 QUALITY ASSURANCE

A. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

B. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

C. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.

D. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification are those scheduled and shall represent the minimum level of construction. Equipment manufactured by Loren Cook, Greenheck, and Jenn Aire shall be permitted to bid these specification.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 GENERAL

A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished, with indicated capacities and characteristics.

B. Belt Tensioner: All fans shall be furnished with a factory installed automatic belt tensioner to provide proper belt tension at all times.

C. Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

1. The fan class shall be based on 115% of the fan rotational velocity at design conditions.
2. Fan Shaft: Turned, ground, and polished steel, designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.

D. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor: 1.4.

E. Belts: Oil-resistant, non-sparking, and non-static.

F. Motors: Motors shall be selected for at least 115% of the brake horsepower at design conditions without extending into the service factor.

G. Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 HP; fixed pitch for use with motors larger than 15 HP. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions.

1. Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan cabinet.

H. Shaft Bearings: Provide type indicated, having a median life "Rating Life" (AFBMA L50) of 200,000, calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.

I. Roof Curbs: Prefabricated, heavy-gauge, galvanized steel; mitered and welded corners; 2-inch-thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2-inch wood nailer. Size as required to suit roof opening and fan base.

J. Accessories: The following items are required as indicated in the schedule:

1. Disconnect Switch: Non-fusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, 16-gauge aluminum or brass wire.
3. Dampers: Counter-balanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

2.03 CEILING-MOUNTED EXHAUST FANS

A. General Description: Centrifugal fan designed for installation in ceiling, wall, or concealed inline applications.

B. Housing: Galvanized steel lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Aluminum louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Fan Speed Control: Solid state, capable of controlling fan speed from full speed to approximately half speed. Mount on fan housing, unless show otherwise

G. Accessories: Manufacturer's standard roof jack, wall cap, eave vent, brick vent, and transition fittings as indicated and scheduled.

2.04 IN-LINE FANS

A. General Description: Fan shall be duct mounted, belt-driven or direct-drive as indicated, centrifugal square inline. Fan shall bear the AMCA certified ratings seal for sound and air performance.

B. Construction: The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Pivoting motor plate shall utilize threaded L-bolt design for positive belt tensioning. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.

C. Fan Wheel: Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

D. Bearings: Bearings shall be designed and individually tested specifically for use in air handling

applications. Construction shall be heavy duty regreasable ball type in a pillow block cast iron housing selected for a minimumL50 life in excess of 200,000 hours at maximum cataloged operating speed.

E. Belts and Drives: Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

F. Accessories: The following accessories are required as scheduled:

1. Factory installed and wired disconnect switch
2. Belt guard
3. Vibration isolation spring hangers

2.05 MOTORS

A. Torque Characteristics: Sufficient to accelerate the driven loads satisfactorily.

B. Motor Sizes: Minimum sizes and characteristics as indicated. If not indicated, large enough so that the driven load will not require the motor to operate in the service factor range.

C. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).

D. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors. Provide permanent-split capacitor classification motors for shaft-mounted fans and capacitor start classification for belted fans.

E. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design B.

1. Bases: Adjustable.
2. Bearings: The following features are required:
   a. Ball or roller bearings with inner and outer shaft seals.
   b. Grease lubricated.
   c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
3. Enclosure Type: The following features are required:
   a. Open drip-proof motors where satisfactorily housed or remotely located during operation.
   b. Guarded drip-proof motors where exposed to contact by employees or building occupants.
4. Overload protection: Built-in, automatic reset, thermal overload protection.
5. Noise rating: Quiet.
6. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, Test Method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors" in accordance with IEEE Standard 112, Test Method B.
7. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, and special features.

F. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Support floor-mounted units on concrete equipment bases using housed spring isolators as

scheduled. Secure units to anchor bolts installed in concrete equipment base.

B. Suspended Units: Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs or rubber snubbers as scheduled.

C. Arrange installation of units to provide access space around units for service and maintenance.

End of Section 23 34 16

SECTION 23 37 13 - GRILLES, REGISTERS, DIFFUSERS, AND LOUVERS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all supply, return and exhaust registers, diffusers, grilles, and louvers as specified and as indicated on the drawings.

1.02 QUALITY ASSURANCE

A. Codes and Standards:

1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
2. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
3. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
4. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis of design for the grilles, registers, and diffusers are those listed and scheduled and shall represent the minimum level of construction. Units manufactured by EH Price, Carnes, Krueger, Titus and Nailor shall be considered equal to these specifications. The basis of design for the louvers are those listed and scheduled and shall represent the minimum level of construction. Units manufactured by Industrial Louver, Louvers and Dampers, Penn Ventilator, Ruskin, and Greenheck shall be considered equal to these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 AIR DIFFUSERS

A. Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule.

2.03 REGISTERS AND GRILLES

A. Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Provide wall registers and grilles that have, as minimum, temperature and velocity traverses,

throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.

C. Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

D. Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.

2.04 LOUVERS

A. Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.

C. Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.

D. Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.

E. On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

F. Blank-off any unused portions of the louver with lined sheet metal panels. Back of the panels shall be insulated with 1" thick, 3 lb density duct liner. Seal all joints on back panel air tight.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

End of Section 23 37 13

SECTION 23 54 13 – GAS FIRED FURNACES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct installation of gas-fired furnaces and other items connected to the system as defined in the specifications and on the drawings.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division1 Submittal Procedures.

B. Product Data: Submit product data, including manufacturer's product sheet for the specified products.

C. Shop Drawings:

1. Submit shop drawings in including the following:
   a. Equipment, piping and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.
   b. Piping, valves and fittings shipped loose showing final location in assembly
   c. Control equipment shipped loose, showing final location in assembly
   d. Field wiring diagrams
   e. Dimensions, internal and external construction details, installation clearances, recommended method of installation, sizes and location of mounting bolt holes
   f. Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories, controllers.

D. Quality Assurance:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
3. Manufacturer's Instructions: Manufacturer's installation instructions.

E. Closeout Submittals:

1. Warranty: Warranty documents specified herein
2. Operation and Maintenance Data: Operation and maintenance data for installed products. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance. Include names and addresses of spare part suppliers.
3. Provide brief description of unit, with details of function, operation, control and component service

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

1.04 DELIVERY, STORAGE & HANDLING

A. Comply with the manufacturer's lead time requirements to avoid construction delays.

B. Packing, Shipping, Handling and Delivery:

1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact
2. Ship, handle and unload units according to manufacturer's instructions

C. Storage and Protection:

1. Store materials protected from exposure to harmful weather conditions
2. Factory shipping covers to remain in place until installation

1.05 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

B. Warranty: Commencing on Date of Installation

C. Aluminized Steel Heat Exchanger – Limited 10-year warranty.

D. All other covered components - Limited 1-year warranty.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification is Trane and shall represent the minimum level of construction. Equipment manufactured by Lennox, York, and Rheem shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 GAS FURNACES

A. Product: Downflow, Upflow or Horizontal Gas Furnaces as scheduled and indicated on the drawings.

B. The basis for gas-fired furnaces is Trane which shall represent the minimum level of construction. Products manufactured by Lennox, York and Rheem shall be permitted to bid these specifications.

C. Cabinet

1. Low-profile, narrow width cabinet
2. Heavy gauge cold rolled steel construction
3. Pre-painted finish
4. Flanges provided on supply air opening for ease of plenum connection or alignment with indoor coil
5. Foil faced insulation on sides and back of heating compartment
6. Gas piping inlets and electrical inlets on both sides
7. Safety interlock switch to automatically shut off power to unit when blower compartment access panel is removed
8. Coil match-up

9. Return Air Entry

D. Heating System:

1. Heat Exchanger Assembly
   a. Heavy gauge aluminized steel
   b. Multi-pass crimped seam design clamshell
   c. Secondary heat exchanger condenser coil constructed of aluminum fins fitted to stainless steel tubes
   d. Coil is factory tested for leaks
   e. Laboratory life-cycle tested
   f. Condensate drain header box assembly located in front of coil
2. Header Box
   a. Collects flue condensate for disposal through drains
   b. Drains are located on each side of cabinet
   c. Condensate drain trap is included for field installation
3. Flue Condensate Trap Assembly
   a. Mounted outside the conditioned air stream on either side of cabinet in upflow and downflow applications
   b. Mounted below the cabinet in horizontal applications (or remotely up to 5ft away from unit)
   c. Drain cap on trap for easy cleaning and winterizing
   d. 90 degree street elbow furnished for ease of drain trap installation
4. Inshot Burners
   a. Aluminized steel, trouble free operation
   b. Burner assembly to be removable from unit as single component
5. Hot Surface Ignitor
   a. Silicon nitride ignitor
   b. Ignition leads are constructed of nickel plated copper, enclosed in high temperature Teflon insulation
   c. Cemented to steatite block for leakage protection
6. Two-Stage Gas Control Valve
   a. Redundant combination
   b. Compact Control to contain Manual shutoff, automatic electric valve (dual) and gas pressure regulation
7. Combustion Air Inducer
   a. Shaded pole heavy duty blower pre-purges heat exchanger and safety vents flue products
8. Flame Rollout Switches (2)
   a. Factory installed on burner box with manual reset for protection from abnormal operating conditions
9. Limit control
10. Pressure switch

E. Venting

1. Concentric Vent

F. Blower

1. Multi Speed Direct drive blower
2. Statically and dynamically balanced
3. Resiliently mounted
4. Easily removed for servicing

5. Blower speeds are easily changed on the Integrated Furnace Control

G. Controls

1. Commercial Touchscreen Thermostat
2. 24 Volt Transformer
   a. Furnished and factory installed in control box
   b. 40 VA transformer has circuit breaker wired in series
3. Field Wiring Make-up Box
   a. For line voltage wiring
   b. Box may be factory installed internally or installed externally on either side
4. Integrated Furnace Controls
   a. Controls combustion air inducer
   b. Contains all necessary controls and relays to operate furnace
   c. Flame sensor assures safe and reliable operation
   d. Ignition control has a red LED to indicate status for troubleshooting

H. Accessories:

1. Venting:
   a. Concentric termination kit (direct vent)
   b. Flush-Mount termination kit
   c. Wall assembly termination kit (direct vent)
   d. Wall Ring
   e. Close Couple (direct vent)
   f. Roof Termination Flashing Kit
2. Cabinet:
   a. Return Air Base
3. Controls:
   a. Thermostat
4. Filter:
   a. Air Filter and Rack Kit for Upflow Side Return Air Applications

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and spec sheets.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.03 INSTALLATION

1. Install Gas Furnace in accordance with manufacturer's instructions and regulations of authorities having jurisdiction.

End of Section 23 54 13

SECTION 23 62 13 - AIR COOLED CONDENSING UNITS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the Condensing Unit/A-coil combinations as specified and shown on the drawings.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for the equipment in this specification is Trane and shall represent the minimum level of construction. Equipment from Lennox, Goodman, Carrier, or Comfortmaker shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 COILS AND CONDENSING UNITS

A. Provide Trane, or approved equal, fully cased direct expansion coils and 208 volt, single phase condensing units.

B. Provide with expansion valves, filter-dryers, sight glasses, timed-off controls, crankcase heaters and low ambient controls to allow operation down to 30 F outdoor air temperature

C. Coils and condensing units shall be as scheduled on plans.

D. Provide all units with programmable thermostat and all thermostat control cabling. Thermostats shall be installed behind clear Lexan covers with tumbler style cam lock.

PART 3 EXECUTION

3.01 THERMOSTAT INSTALLATION

A. This contractor will be responsible for all thermostat installation and control wiring.

End of Section 23 62 13

SECTION 26 01 00 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, General Requirements (Division 1), and Section 23 05 13 - ELECTRICAL PROVISIONS OF HVAC WORK, Section 22 05 13 – ELECTRICAL PROVISIONS OF PLUMBING, and Section 21 05 13 – ELECTRICAL PROVISIONS OF FIRE PROTECTION apply to the work specified in Division 26 - ELECTRICAL.

1.02 DESCRIPTION OF WORK

A. The Electrical Contract includes all labor, material, and equipment required for the complete electrical systems as shown and specified.

1.03 QUALITY ASSURANCE

A. Each major component of equipment shall have the manufacturer's name, address, model number, rating, and UL label securely affixed in a conspicuous place.

B. All equipment of one type (such as panelboards, switches, wiring devices, etc.) shall be the product of one manufacturer, unless specified otherwise.

C. In the event of discrepancies between the drawings and specifications, the contractor shall advise the engineer before proceeding with the work in order that correct progress is ensued.

1.04 SHOP DRAWINGS AND SUBMITTALS

A. Shop drawings shall be submitted as specified in Division 1. Product data shall be submitted for all materials and equipment specified in DIVISION 23. Shop drawings and submittals must be submitted in PDF format and emailed to the design team.

B. Shop drawings for equipment ‘Packages” shall be complete and include all items to be provided by a manufacturer’s representative or supply house. No partial submittals will be reviewed or approved without a complete and total equipment submittal.

C. Each shop drawing shall include a letter indicating all deviations from the drawings and/or specifications.

D. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:

1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
2. Capacity, pressure drop, rpm, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
3. Dimensional drawings showing layout, connection points, and detailed layout of components.
4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.
5. Conspicuously mark on each submittal the exact model, fittings, accessories, and devices to be supplied. When a schedule is shown on the drawings or in the specifications, provide a copy of that schedule with the shop drawing indicating the equipment capacities and characteristics of the actual equipment being proposed.
6. Tags for equipment submitted shall match the tags indicated on the design drawings or specifications. Where equipment is noted on the drawings and not scheduled, refer to plan note and sheet number on the submittal.

E. they meet the requirements of the drawings and specifications before forwarding to the architect and engineer. All shop drawings submitted shall bear the stamp of the contractor to show that they have been reviewed in detail.

F. No work shall be fabricated and no equipment ordered until the architect and engineer have returned acceptable reviewed shop drawings.

1.05 PROJECT SEQUENCING

A. The contractor shall refer to the architectural plans and specifications for areas of work and general schedules to determine the scope of work required during each phase of the construction.

B. All temporary services, temporary electrical connections to HVAC valves, dampers, etc. which are not indicated, but required by the phasing plan, shall be included in the base bid.

1.06 SUBSTITUTIONS

A. The materials, products, and equipment described in these specifications or on the drawings establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. Listing of these manufacturers shall in no way be construed as a device intended to limit the bidders to those specifically listed.

B. Reference to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number, shall be interpreted as having established a standard of quality and shall not be construed as limiting competition. Articles, fixtures, etc. of equal quality by manufacturers listed in this specification for the applicable use, shall be acceptable, subject to spatial, structural, and electrical constraints of the project design.

C. The Engineer reserves last opinion as to a product's equality or superiority to that specified.

1.07 DEFINITIONS

A. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

B. Install: The term "install" is used to describe operations at the project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

C. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

D. Furnished by Owner or Furnished by Others: The item will be furnished by the Owner or Others. It is to be installed and connected under the requirements of this Division, complete and ready for operation, including all items incidental to the Work, including all services necessary for proper installation and operation. The Installation shall be included under the guarantee required by this Division.

E. The design engineer, referred to as "engineer" shall mean the engineering firm, HOSS & BROWN ENGINEERS, INC., Contact person: Brandon Frey.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Three (3) Flash Drives containing PDFs of Operation and Maintenance (O&M) Manuals shall be submitted as described below. Files and folder names shall be clearly labeled. Folder structure and names shall be intuitive and clearly labeled.

B. Before project close-out, submit O&M operating, maintenance instructions, and parts lists for equipment provided. Include in the manual a list of emergency service organizations capable of rendering service for each piece of equipment.

C. Keep in a safe place all keys, wrenches, and other specialty tools furnished with equipment.

Present to owner at project close-out and receive a receipt showing the Owner has received the same.

D. At the completion of the project furnish to the Architect for the Owner O&M brochures divided and tabbed, containing all data, diagrams, capacities, spare part numbers, manufacturers service and maintenance data, warranties, guarantees, etc., including local contacts and escalation schedule complete with addresses and telephone numbers, of all equipment, apparatus, and system components furnished and installed under this Division of the specifications.

1.09 CODES AND ORDINANCES

A. All work shall be in accordance with applicable codes, rules, ordinances, and regulations of local, state, and federal governments and other authorities having jurisdiction.

B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard, to any ordinances, laws, codes, rules, or regulations bearing on work, the contractor shall execute work in accordance with such without increased cost to the owner, but not until he has referred such variances to the engineer.

C. The contractors shall secure and pay for the necessary permits and certificates of inspection for their trade. Keep record of all permits and inspections and submit two copies to the engineer with request for final inspection.

1.10 OWNER TRAINING

A. Contractor shall demonstrate to the owner that all mechanical systems installed under this division of the specifications are complete and operating as intended. Contractor shall provide documentation to owner of owner training.

B. Any adjustments or other additional work required as a result of failure of any system to comply with the intent of this specification shall be accomplished at no additional cost to the Owner.

1.11 WARRANTY

A. This contractor shall warrant that the complete systems installed under this contract shall be free of defects in workmanship and materials for a period of one (1) year from the date of substantial completion by the arch/owner.

B. If defects occur during the one year guarantee period, this contractor shall repair or replace such defects at no expense to the owner and to the satisfaction of the owner and engineer.

PART 2 PRODUCTS

2.01 GENERAL

A. Where the quality of required material is not specified, the Contractor shall furnish a first class standard item as approved by the Architect/Engineer.

B. Capacities of equipment and materials shall not be less than those indicated.

C. All work performed shall provide a neat and workmanlike appearance when completed, to the satisfaction of the engineer.

D. Provide 3-1/2” concrete base for all floor mounted equipment unless shown or noted otherwise.Provide 6x6 welded wire fabric reinforcing minimum or as required by the structural engineer.

E. Adequately protect equipment from damage after delivery to the jobsite. Cover with heavy polyethylene plastic. Elevate equipment when there is danger of water damage. Equipment damaged will be rejected.

F. Any scratches to factory finishes shall be touched up using factory supplied paint before final

acceptance. If extensive damage to factory finishes has occurred, equipment panels shall be replaced to the satisfaction of the engineer. If rust has formed, remove as recommended by the manufacturer prior to touch-up.

2.02 EQUAL PRODUCTS OF LISTED MANUFACTURERS

A. In general, the specifications and drawings identify required materials and equipment by naming first the manufacturer whose product was used for the basis of design. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality, construction and dimensional requirements for comparing the other manufacturer's products. The capacity and performance of all equipment shall meet or exceed what is indicated on the drawings and/or scheduled.

B. Where other manufacturer's names are listed, they are considered approved for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers have been shown.

C. Where other than first named products are used, it shall be the responsibility of the contractor to determine prior to bid time that his proposed materials and equipment selections do not require adjustments in the mechanical or electrical connections as shown on the drawings. The contractor shall include in his bid all costs associated with any required adjustments.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all equipment in strict accordance with the manufacturer's recommendations and the shop drawings reviewed by the Engineer.

B. The complete installation shall function as designed and intended with respect to efficiency, capacity, and noise level, etc. Any abnormal noise caused by rattling equipment, conduit, or fixtures will not be acceptable

C. Locations of equipment, conduit, and other work are indicated diagrammatically on the drawings. Each contractor shall coordinate exact locations subject to structural conditions, work of other contractors, access requirements, and the approval of the architect and engineer.

D. Any item interfering with proper placement of other work shall be removed and relocated without extra cost if reasonable coordination would have eliminated the interference. Damage to other work caused by this contractor shall be restored as specified for new work.

E. Written dimensions are preferred over scaled dimensions. When written dimensions are not available, the contractor shall be responsible for determining the proper installed location.

F. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification.

G. Contractor shall perform initial start-up of systems and shall provide necessary supervision and labor to make the first seasonal change-over of systems. Owner's operating personnel shall be present during this operation.

H. It is the contractor's responsibility to provide materials and trim which fit properly the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.

3.02 CONNECTIONS TO BUILDING STRUCTURE

A. Any item connecting to building structure shall be done in a manner accepted by the structural engineer.

B. When bar joists are used for steel construction, items shall be supported from angle iron spanning the top chord of the joists.

3.03 CLEANING

A. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.

3.04 VISIT TO THE SITE

A. Before submitting his bid, the Contractor shall visit the actual location of the job and shall fully understand the scope of the work to be done and the conditions under which it is to be performed. In no case shall additional compensation be granted when existing conditions could reasonably be determined.

3.05 EXISTING UTILITIES

A. Locate and mark all known utilities prior to proceeding with work. Proceed with caution since unmarked utilities may exist on site.

B. Should any existing utilities be damaged or disrupted, immediately notify Owner. Repair the existing utilities and related equipment to the condition/working order prior to starting work. All costs of repairs shall be paid by the contractor(s) responsible for the damage.

C. The Contractor shall closely coordinate all utility downtime with the Owner and Architect giving a minimum fourteen (14) day notice prior to downtime.

D. Downtimes are to be held to a minimum duration with the Owner being notified as to the extent of said downtime.

End of Section 26 01 00

SECTION 26 01 13 - ELECTRICAL CONNECTIONS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The Electrical Contractor shall provide all conduit and wiring and shall connect complete and ready for operation all electrical motors and equipment in the other contracts. The other contractors shall furnish to the Electrical Contractor all switches, electrical controls, and other accessories required. Installation of all motors, equipment, etc., shall be made by the Contractor furnishing the equipment, except otherwise indicated.

B. Unless specified or shown otherwise, variable speed drives will be furnished by the Contractor providing the motor, and installed by the Electrical Contractor. The Electrical Contractor shall provide the control switch as shown or noted and motor starters per Section 262913. Control switch cover plate shall be engraved denoting item to be controlled and the switch position shall be engraved "AUTO-OFF TEST," "ON-OFF," or other applicable labeling as approved or noted.

C. The Electrical Contractor shall provide disconnect switches as shown.

D. The Electrical Contractor shall make all required electrical connections as hereinafter listed.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 ELECTRICAL CONNECTIONS

A. The Electrical Contractor shall provide all conduit and wiring and shall connect complete and ready for operation all electrical motors and equipment for other trades as shown on the drawings and as required for complete and operating systems.

B. For specific equipment listed below, provide the following:

Mechanical/Plumbing/HVAC Items:

1. Domestic Water Pumps: The Electrical Contractor shall provide disconnects and motor starter/contactors as indicated. The Electrical Contractor shall make all required electrical connections.
2. Single Phase Exhaust Fans: The MC shall provide the single phase exhaust fans with disconnecting means. The Electrical Contractor shall provide the line voltage thermostat as may be indicated. The Electrical Contractor shall make all required electrical connections.
3. Three Phase Exhaust Fans: The MC shall provide the three phase exhaust fans with disconnecting means. The Electrical Contractor shall provide the line voltage thermostat as may be indicated. The Electrical Contractor shall make all required electrical connections.
4. Unit Heaters: The MC shall provide the single phaseunit heaters with disconnecting means. The Electrical Contractor shall provide the line voltage thermostat as may be indicated. The Electrical Contractor shall make all required electrical connections.
5. Temperature Controls: The temperature control supplier will provide all low voltage control wiring. The EC shall provide indicated 120 volt power supplies and connection. The EC shall provide all rough-in boxes and conduits for thermostat indicated under the direct supervision of the Temperature Control Contractor. Coordinate all requirements with the Temperature Control Contractor.

Communications/Security Items:

6. Fire Alarm: The fire alarm supplier/contractor will provide all low voltage control wiring. The EC shall provide indicated 120 volt power supplies and connections. The EC shall provide all rough-in boxes and conduits for devices as indicated under the direct supervision of the Fire Alarm Contractor. Coordinate all requirements with the Fire Alarm Contractor.
7. Structured Cabling System: The structured cabling system supplier/contractor will provide all low voltage control wiring. The EC shall provide indicated 120 volt power supplies and connections. The EC shall provide all rough-in boxes and conduits for devices as indicated under the direct supervision of the Structured Cabling Contractor. Coordinate all requirements with the Structured Cabling Contractor.

General Contractor/Architect Items:

8. Handicapped Door Operators: The Electrical Contractor shall provide disconnect as required and make all rough-ins for controllers. The Electrical Contractor shall make all required electrical connections.
9. Security Door Lock System: The Electrical Contractor shall provide disconnect as required and make all rough-ins for controllers. The Electrical Contractor shall make all required 120 volt and low voltage electrical connections.
10. Washers and Dryers: The Electrical Contractor shall verify NEMA configurations of cord and plugs sets for both washers and dryers provided. The Electrical Contractor shall install cord and plug kits for dryers. The Electrical Contractor shall make all required electrical connections.

End of Section 26 01 13

SECTION 26 01 14 - ELECTRICAL SERVICE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The electrical service shall be as indicated on the plans.

B. The contractor shall pay any and all required utility service fees associated with this project direct to the local utility company.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 COORDINATION WITH LOCAL UTILITY

A. The descriptions of work below are general in nature. Contractor shall coordinate all work with the local utility and shall provide all items required by the local utility for a complete and operating service.

3.02 Contractor and Local Utility Responsibilities

A. Definitions:

1. Contractor: EC
2. Utility: Local Utility

B. Concrete Pads – Concrete pads for pad-mounted transformers and sectionalizers provided by the contractor shall meet the local utility standards. Coordinate dimensions and conduit penetration locations with utility prior to pouring pad.

C. Conductor Length – Conductors provided by the contactor for connection by local utility shall have sufficient length for connections to equipment.

D. Scope Matrix

Contractor and Local Utility Scope	Furnishes (EC or Utility)	Installs (EC or Utility)
Pad-Mounted Transformer	Utility	Utility
Concrete Transformer Pad	EC	EC
Primary Conduit	EC	EC
Primary Conductors	Utility	Utility
Primary Trenching & Backfilling	EC	EC
Secondary Conduit	EC	EC
Secondary Conductors	EC	EC
Secondary Trenching & Backfilling	EC	EC
Secondary Transformer Connections	Utility	Utility
Pole-Mounted Transformer	Utility	Utility
Transformer Connections	Utility	Utility
Secondary Mast(s)	EC	EC
Secondary Overhead Cable to Mast(s)	EC	EC

Secondary Cable Up Mast(s)	EC	EC
Connections at Mast(s)	Utility	Utility
Pad-Mounted Sectionalizer	Utility	Utility
Concrete Sectionalizer Pad	EC	EC
Upstream Conduit	Utility	Utility
Upstream Conductors	Utility	Utility
Upstream Trenching & Backfilling	EC	EC
Upstream Connections	Utility	Utility
Downstream Conduit	EC	EC
Downstream Conductors	Utility	Utility
Downstream Trenching & Backfilling	EC	EC
Downstream Connections	Utility	Utility
Meter	Utility	Utility
Meter Can/Socket	EC	EC
CT/CP Cabinet [usually if 400A or greater]	EC	EC

End of Section 26 01 14

SECTION 26 01 15 - ELECTRICAL RELATED WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The following is the work required by the General Contractor to facilitate the work of the Electrical Contractor.

1. Openings and chases.

B. The following is the work required by the Electrical Contractor to facilitate the work of his contract.

1. Cutting and patching.
2. Excavation and backfilling.
3. Conduit sleeves.

1.02 RELATED DOCUMENTS

A. Refer to Division 31 for backfilling requirements.

B. Unless otherwise addressed in the specification, as a minimum, backfill in 6” lifts, compacting to a minimum of 90%. The first 12” of fill above any buried item outside the building shall be sand in order to contrast with other fill material. Provide a yellow warning tape at the top of the sand layer.

PART 2 PRODUCTS

2.01 CONDUIT SLEEVES

A. Conduit sleeves and supports shall be provided and the Contractor shall be responsible for their proper and permanent location. Conduit will not be permitted to pass through footings or beams without consent of the Architect.

B. Conduit sleeves will be required in all penetrations through new exterior walls, masonry walls, floors and fire rated gyp board walls. Sleeves shall be either Schedule 5 steel pipe, EMT conduit, field fabricated from minimum 16 gauge steel with 2" overlap at the seam, or as required by UL listed fire-stopping system.

C. Conduit sleeves will not be required in existing wall penetrations of masonry construction when such openings are made by "core-drilling.”

PART 3 EXECUTION

3.01 GENERAL CONTRACTOR'S WORK

A. The General Contractor shall leave such openings and chases in new construction for pipes, cabinets, access doors, and equipment as may be necessary or directed by the Architect to facilitate the work of the Electrical Contractor and to refinish around same. The Electrical Contractor shall properly advise in due time as to the location and sizes of such openings and chases.

3.02 ELECTRICAL CONTRACTOR'S WORK

A. The Electrical Contractor shall be responsible for locating and setting his own sleeves, and be well aware of the job progress to avoid unnecessary delay for setting of same.

B. The Electrical Contractor shall be responsible for cutting his own holes in existing construction, unless noted otherwise, and for patching and finishing around same. Any holes left in walls when existing devices or conduit is removed by the Contractor shall be patched and finished by the

Contractor.

C. The Electrical Contractor shall do all excavation and backfilling necessary to complete work under this contract. Lines shall be used to lay out the trenches for underground work. Trenches shall be of sufficient width and shall be cribbed and braced to prevent cave-in or settlement. Trenches close to walls and columns of the building shall not be excavated without the Architect's prior consent.

D. Hand backfill and tamp into place at sides of conduits until installation has been approved.

E. All sidewalks, street or alley surfaces that have to be broken in connection with this contract shall be patched to the satisfaction of the Architect.

3.03 CONDUIT SLEEVES

A. Space between sleeves and conduit in outside walls shall be filled or tightly caulked with oakum, butyl rubber, link seals or other approved equally effective material to resist the penetration of water. Conduit sleeve shall be sufficient diameter to provide approximately 1/2" clearance around conduit.

B. Space between sleeves and conduits in other wall construction shall be the diameter necessary to provide the clearance required by the UL listed fire stopping method chosen by the contractor. Shop drawings of the fire stopping method shall be approved prior to the setting of any sleeves and shall clearly define the fire stopping method and required sleeve clearances.

C. Sleeves shall be set no closer than two pipe diameters center to center and shall be set 3/4" past all wall surfaces, and be securely anchored to the wall.

End of Section 26 01 15

SECTION 26 01 17 - FIRESTOPPING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested firestop systems shall be used in specific locations as follows:

B. Penetrations for the passage of cables, conduit, and other electrical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

1.04 REFERENCES

A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1997).

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL Standard 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. The UL Fire Resistance Directory includes the following:

1. Firestop Devices (XHJI)
2. Fire Resistance Ratings (BXUV)
3. Through-Penetration Firestop Systems (XHEZ)
4. Fill, Voids, or Cavity Material (XHHW)
5. Forming Materials (XHKU)

C. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

D. Inspection Requirements: ASTM E 2174 – 01, “Standard Practice for On-site Inspection of Installed Fire Stops.”

E. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.

F. All major building codes: ICBO, SBCCI, BOCA, UBC, and IBC.

G. NFPA 101 - Life Safety Code.

1.05 QUALITY ASSURANCE

A. A manufacturer's direct representative shall be on-site during initial installation of firestop systems to train appropriate contractor personnel in the proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E-814, UL Standard 1479 or UL Standard 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer’s specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Section 1300.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.07 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.08 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Scheduling

1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer's names are intended to establish type and quality of items to be provided via the contract. The materials, products, and equipment described in the specifications or on the drawings establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. Listing of these manufacturers shall in no way be construed as a device intended to limit the bidders to those specifically listed.

B. Manufacturers of equal or superior products consistent with the specifications will be acceptable upon written request and publication via addenda. No oral commitments will be binding.

C. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, 800-879-8000
2. STI firestop
3. 3M fire barrier products.

D. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 FIRESTOPPING, GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.03 MATERIALS

A. Use only firestop products that have been UL Standard 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices are installed prior to concrete placement for use with non-combustible and combustible non-metallic conduit, or electrical cable bundles, penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device or approved equal

C. Sealants, foams or caulking materials for use with non-combustible items including rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant or approved equal
2. Hilti CP 620 Fire Foam or approved equal

D. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including PVC jacketed, flexible cable or cable bundles and non-metallic conduit, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant or approved equal

E. Foams, Intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant or approved equal
2. Hilti CP 618 Firestop Putty Stick or approved equal

F. Non-curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti CP 618 Firestop Putty Stick or approved equal

G. Wall opening protective materials for use with UL listed metallic and specified non-metallic

outlet boxes, the following products are acceptable:

1. Hilti CP 617 Firestop Putty Pad or approved equal

H. Materials used for complex penetrations made to accommodate cable trays, multiple conduits, electrical busways, the following products are acceptable:

1. Hilti FS 637 Trowelable Firestop Compound or approved equal
2. Hilti FS 657 FIRE BLOCK or approved equal
3. Hilti CP 620 Fire Foam or approved equal

I. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel conduits, electrical busways, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK or approved equal

J. Provide a firestop system with a "F" Rating as determined by UL Standard 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

PART 3 EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
2. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized

standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

End of Section 26 01 17

SECTION 26 05 15 – LOW VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the wire as specified and the circuiting as shown on the drawings.

1.02 COLOR CODING OF WIRING

A. Color coding for 120/208 volt systems shall be Black/Blue/Red for phase conductors, White for neutral and green for grounding conductors.

B. Color coding for 277/480 volt systems shall be Brown/Orange/Yellow for phase conductors, Grey/White for neutral and green for grounding conductors.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification is Southwire and shall represent the minimum level of construction. Material manufactured by Senator Wire and Cable, Encore Wire and Cable, and Cerro Wire LLC shall be permitted to bid these specifications.

2.02 LOW VOLTAGE WIRE (600V AND LESS)

A. All power wires and cables shall be copper, minimum #12 awg, unless noted otherwise, and shall be Code Type THWN or THHN.

B. All power wires and cables #10awg and smaller shall be annealed soft copper, solid or stranded construction, unless noted otherwise, and shall be Code Type THWN or THHN.

C. All power wires and cables #8awg and larger shall be annealed soft copper, compressed strand construction, and shall be Code Type THWN-2 or THHN.

D. All wiring shall be in conduit, unless noted otherwise.

E. All HVAC equipment feeders shall be copper code type THWN/THHN.

2.03 LOW VOLTAGE CABLES (600V OR LESS)

A. At the Contractor's option all interior branch circuits may be type MC cable with listed fittings and couplers in lieu of EMT conduit and conductors. All homeruns to panels will be made with EMT conduit (no MC connections to panel cans). Color coding shall be maintained.

PART 3 EXECUTION

3.01 CIRCUITING

A. The circuiting of all light and receptacle outlets has been shown on the plans, and the Contractor shall follow this circuiting layout.

B. Each 120 volt outlet circuit shall be provided with dedicated neutral conductors. Three phase, four wire homeruns of 120 volt branch circuits will not be accepted.

C. Each light fixture shall be provided with a dedicated fixture whip from a junction box. The practice of 'daisy-chaining' from fixture to fixture will not be accepted. Multiple fixture whips from a single box is acceptable.

D. Machine or power pulling of cables into raceways shall be accomplished pulling stresses shall not exceed those recommended by the manufacturer.

E. All cables shall be lubricated with "Polywater," or equally effective fire retardant material.

End of Section 26 05 15

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Supplement the grounded neutral of the electrical distribution system with an equipment grounding system, installed so that metallic enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment, etc., operate continuously at ground potential and provide a low impedance path for ground fault currents.

B. The entire electrical system, including all special power systems, shall be grounded in accordance with the latest adopted version of the National Electrical Code.

C. Grounding conductors shall be installed in conduits as shown on the drawings. Provide 100% rated dedicated grounding conductors per each 120-volt outlet circuit.

D. Grounding conductors shall be installed in all PVC and Metal conduits.

E. Provide grounding plates in hub room and at main service grounding electrode, as indicated on plans.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. All materials shall be manufactured by:

1. Burndy
2. B-Line Systems
3. Crous Hinds
4. Gould
5. General Electric
6. Ideal Industries
7. Thomas and Betts
8. Western Electric

B. Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC requirements and as noted on drawings.

C. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 ROD ELECTRODES

A. Rod electrodes shall be copper, 5/8"diameter and 8'-0" long.

2.03 MECHANICAL CONNECTORS

A. Provide electrical terminals, connectors, lugs, and clamps as recommended by the manufacturer's for the indicated applications.

1. Use mechanical (removable) clamps for connections to pipes.
2. Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, and bonding straps as recommended for the types of services indicated.

2.04 GROUNDING BAR (PLATES)

A. Provide ¼"x20"x4" copper bus bar manufactured by Chatsworth Products, Inc. Catalog #10622-020 with #10622-000 Hardward Kit or approved equal.

PART 3 EXECUTION

3.01 GENERAL

A. Examine areas and conditions under which electrical grounding connections are to be made and notify the Architect/Engineer in writing of conditions detrimental to proper completion of the work. Work shall not proceed until unsatisfactory conditions have been corrected.

B. Provide all materials, labor, and equipment for an electrical grounding system in accordance with applicable portions of the NEC and NECA. Coordinate electrical work as necessary to interface installation of electrical grounding systems with other work.

C. Grounding and bonding of electrical installations and specific requirements of systems, circuits and equipment required to be grounded shall be accomplished in temporary and permanent construction.

D. The path to ground from circuits, equipment, and conductor enclosures shall be permanent and continuous and shall have ample current carrying capacity to conduct safely any currents liable to be imposed on it, and shall have impedance sufficiently low to limit the potential above ground and to facilitate the operation of the overcurrent devices in the circuit.

E. Where the size of the grounding conductor is not shown, they shall be sized in accordance with the NEC. All grounding conductors shall be a minimum of #12 AWG.

F. Verify that final backfill and compaction has been completed before driving ground rod electrodes.

3.02 EQUIPMENT GROUNDING

A. All receptacles shall be permanently connected to the grounding system with a green wire ground conductor.

B. The metal frame of all motors shall be permanently connected to the grounding system with a green ground conductor.

3.03 INSTALLATION

A. Provide a separate green equipment grounding conductor in all electrical raceways to effectively ground all devices, equipment, and non-current carrying enclosures. Metal conduit shall not be used as the grounding path. The grounding conductors shall be connected to the building electrical system ground.

B. The path to ground from circuits, equipment, and conductor enclosures shall be permanent and continuous and shall have ample current carrying capacity to conduct safely any currents liable to be imposed on it, and shall have impedance sufficiently low to limit the potential above ground and to facilitate the operation of the overcurrent devices in the circuit.

3.04 SERVICE GROUNDING

A. Provide service grounding per NEC Article 250 of the latest adopted Code version, and as shown on the drawings.

B. At the service entrance equipment, bond the utility neutral, building neutral, and building grounding conductor at the building disconnecting means. Refer drawings for exact location and configuration. Connect the ground bus to the building domestic cold water pipe (within 5 feet of the water service entrance per NEC Article 250-50) with a grounding or bonding conductor.

C. Service grounding shall comply with all applicable grounding requirements and rules of the Utility.

D. The earth shall not be used as the sole equipment grounding conductor or fault current path

3.05 BONDING

A. Provide bonding per NEC Article 250, and as shown on the drawings.

B. Electrically conductive materials, such as metal water piping, metal gas piping, ductwork, and structural steel members, that are likely to become energized shall be bonded as specified in NEC Article 250 to the supply system grounded conductor. Or in the case of an ungrounded electrical system, to the electrical system grounded equipment, in a manner that establishes an effective path for fault current.

3.06 TESTING

A. Measure ground resistance to earth. Install additional ground rod and conductors as required if resistance to earth ground is over 25 ohms.

End of Section 26 05 26

SECTION 26 05 33 – ABOVE GROUND RACEWAYS AND BOXES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the conduits and raceways as specified and indicated on the plans.

B. Provide all electrical pull, junction and outlet boxes as specified and shown on the drawings, as well as those required for a complete and code acceptable installation.

1.02 APPROVED MANUFACTURERS

A. The basis of design for the conduit specification is Wheatland Conduit and shall represent the minimum level of construction. Material manufactured by Western Tube, Republic Conduit, and Allied Tube shall be permitted to bid these specifications.

B. The basis of design for the surface raceway specification is Hubbell and shall represent the minimum level of construction. Material manufactured by Wiremold and Western Tube shall be permitted to bid these specifications.

C. The basis of design for the box specification is Steel City and shall represent the minimum level of construction. Material manufactured by RACO, Weigmann, E-Box, and Hoffman shall be permitted to bid these specifications.

PART 2 PRODUCTS

2.01 CONDUITS (600 VOLT AND LESS)

A. All exterior above grade conduits shall be rigid steel conduit or intermediate metal conduit with threaded couplings and fittings.

1. Rigid metal conduit shall be hot-dip galvanized steel. Threads shall be hot galvanized after cutting. Conduit shall be produced in accordance with UL Safety Standard #6 and ANSI C80.1.
2. Intermediate metal conduit shall be hot galvanized steel OD with an organic corrosion resistant ID coating. Threads shall be hot galvanized after cutting. Conduit shall be produced in accordance with UL Safety Standard #1242 and ANSI C80.6.

B. All other conduit shall be E.M.T. thinwall with compression, or setscrew couplings and fittings.

1. Electrical metal tubing shall be hot galvanized steel OD with an organic corrosion resistant ID coating. Conduit shall be produced in accordance with UL Safety Standard #797 and ANSI C80.3
2. Provide setscrew couplings and fitting for NEMA 1 installations and compression couplings and fitting for NEMA 3R installations as a minimum.

2.02 JUNCTION AND PULL BOXES

A. Junction and pull boxes shall be galvanized metal of the knockout type.

2.03 OUTLET BOXES

A. All outlet boxes for light fixtures, receptacles, and wall switches shall be of the galvanized knockout type. Lighting fixture outlet boxes in ceiling shall be not less than 4" square of the knockout type. Gangable type boxes shall be used in all gypboard surfaces.

B. Provide gang boxes for all multi-switch locations. 277 volt installations require separate partitions per NEC.

2.04 BOXES AND CONDUIT FOR DATA AND/OR PHONE OUTLETS

A. Unless noted otherwise, for data/phone outlets, provide a 4x4 deep back box with 2x4 trim ring. Extend a ¾" conduit up inside the wall, roll horizontal in the ceiling space, and provide a protective bushing at the end of the conduit. Where ceiling is drywall or other inaccessible surface, extend the conduit to the nearest accessible location and provide a label at the end of the conduit indicating outlet location.

PART 3 EXECUTION

3.01 CONDUITS (600 VOLT AND LESS)

A. Single tubes will be used for all circuits, but more than one circuit may be carried in each conduit, provided the number of conductors and size of conductors are proportioned in accordance with the rules of the NEC, and conduits are amply large to allow for removal and replacement of conductors when necessary. (40% fill rate.)

B. Where conduit is carried in walls, it shall be thoroughly bedded and not visible. In placing conduits, they shall be so located as to not weaken or injure the construction of the building in any way, and the installation of these shall be approved by the Architect.

C. Joints must be made so the ends of the pipes come together in the center of the coupling.

D. All conduit shall be run parallel or perpendicular to the building surfaces.

E. All conduit shall be concealed except in mechanical and electrical rooms and at all electrical panelboards.

F. Before pipes are covered with concrete, they shall be fished by the Contractor with a steel fish tape to insure that there is no obstruction in the pipes.

G. All empty conduit systems shall be provided with pull strings.

3.02 SURFACE MOUNTED RACEWAY

A. Surface raceway and fittings shall meet all requirements of the National Electrical Code and shall be UL listed and in full compliance with their standard #UL-5.

3.03 JUNCTION AND PULL BOXES

A. Junction and pull boxes shall be provided throughout in accessible locations. Locations shall be approved by the Architect or his representative before installation.

3.04 OUTLET BOXES

A. Outlets shall be installed in the locations shown on the drawings, except outlets may be moved 4 feet in either direction if so directed before roughing, without additional cost to the Owner. Outlet boxes shall be flush mounted on all walls for concealed work.

B. Installation of all outlet boxes shall strictly conform to Article 300 of the National Electrical Code.

3.05 SWITCH AND OUTLET BOXES

A. Switch and outlet boxes installed in concrete and masonry construction shall be straight and level. The Electrical Contractor shall work closely with the General Contractor and masons to insure proper installation to the satisfaction of the Architect.

3.06 THERMOSTAT ROUGH-INS.

A. The Electrical Contractor shall provide rough-in boxes and ½"conduit for thermostats, and other temperature control devices, under the supervision of the temperature controls installation contractor.

End of Section 26 05 33

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all items of electrical identification as specified.

PART 2 PRODUCTS

2.01 PANEL SCHEDULE CARDS AND LABELS

A. Inside each panel door, provide an approved typewritten schedule card showing what each circuit feeds.

B. Switches in main distribution panel shall be clearly and permanently labeled with engraved, white on black laminated plastic plate, mechanically affixed.

C. Provide engraved, white on black, laminated plastic plate, mechanically affixed labels on all panels, transformers, safety switches, motor starter, etc. Where panels, etc., occur in finished rooms, label shall be on inside of the door. Labels shall match designation indicated on the plans.

D. Provide engraved cover plates for switches controlling motor starters, fans, and other items of mechanical equipment.

PART 3 EXECUTION

End of Section 26 05 53

SECTION 26 09 39 – LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Contractor shall provide complete occupancy sensor control devices as indicated on the drawings and specified herein.

B. The contractor shall provide a Lighting control System that meets all performance requirements in accordance with approved plans and specifications.

C. The “Lighting control system” as referred to in this section of the specifications shall include the following subsystems and components of the subsystems: occupancy sensors, time sweep controls, daylighting controls and architectural dimming controls.

1.02 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "Listed" and "Labeled" are used as defined in the National Electrical Code, Article 100.

PART 2 PRODUCTS

1.03 APPROVED MANUFACTURERS

A. The basis for the low voltage switching is Watt Stopper and shall represent the minimum level of construction. Products manufactured by Acuity, Hubbell, and Douglas Lighting shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

1.04 LOW VOLTAGE SWITCHING (EXTERIOR)

A. Provide a complete functioning remote control and signaling system for exterior lighting with the low voltage switching indicated. All equipment, fittings and peripheral devices for correct system operation shall be provided.

B. Complete shop drawings shall be submitted. Drawings shall include all items including internal wiring identification and ratings of components and conductors, details of construction and materials.

C. All line voltage equipment shall be UL listed and shall comply with the National Electrical Code and all applicable regulations.

D. System components shall be as specified on the plans.

E. It is intended that this system include everything required and necessary for proper and complete installation and operation even though every item may not be specifically mentioned. The contractor shall install or deliver to other trades any equipment that must be installed during construction. Contractor shall be responsible for field measurements and coordination for the physical size of all equipment with the architectural requirements of the spaces into which the equipment will be installed.

1.05 OCCUPANCY SENSORS

A. All products shall be Hubbell H-Moss or approved Watt Stopper or approved as specified and indicated on plans.

B. Hubbell H-MOSS Wall Switches, or approved equal, provided in type as indicated on the plans

1. Adaptive Dual Technology Wall Switches
   a. 1000 sq. ft. coverage with photocell, 800w Incandescent, 1000w Fluorescent at 120V AC, 1800w Fluorescent at 277V AC wall switch, AD1277 Series
   b. 400 sq. ft. coverage with photocell, 800W Incandescent, 1000w Fluorescent at 120V AC, 1800W Fluorescent at 277V AC, (Ultrasonic) Switch, AU1277 Series
2. Adaptive Technology Wall Switches
   a. 1000 sq. ft. coverage with photocell, 800w Incandescent, 1000w Fluorescent at 120V AC, 1800w Fluorescent at 277V AC, Passive Infrared Wall Switch, AP1277 Series
3. Passive Infrared Wall Switches
   a. 1200 sq. ft. coverage with photocell, 800w Incandescent, 1200w Fluorescent at 277V AC, WS1277 Series
   b. 900 sq. ft. coverage with photocell, 800w Incandescent, 1000w Fluorescent at 120V AC, WS120 Series
   c. 900 sq. ft. coverage with photocell, 1800w Fluorescent at 277V AC, WS277 Series
   d. 100 sq. ft. coverage with photocell, 600W Incandescent at 120V AC, 1 circuit, 1000W Fluorescent at 120V, 2 circuit, 1800W Fluorescent at 277V AC, WS1277 Series
4. Wall switch sensors shall have 180˚ coverage capability.
5. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
6. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.

C. Hubbell H-MOSS Ceiling, or approved equal, provided in type as indicated on the plans

7. Adaptive Technology Dual Ceiling Sensor
   a. Adaptive Dual Ceiling Sensor, 2000 sq. ft, ATD2000C Series
   b. Adaptive Dual Ceiling Sensor, 1000 sq. ft. ATD1000C Series
   c. Adaptive Dual Ceiling Sensor, 500 sq. ft. ATD500C Series.
8. Adaptive Ultrasonic Ceiling Sensor
   a. Adaptive Ultrasonic Ceiling Sensor, 2000 sq. ft. ATU2000C Series
   b. Adaptive Ultrasonic Ceiling Sensor, 1000 sq. ft. ATU1000C Series
   c. Adaptive Ultrasonic Ceiling sensor, 500 sq. ft. ATU500C Series
9. Passive infrared Ceiling Sensor
   a. Adaptive Passive Ceiling sensor, 1500 sq. ft. ATP1500C series
   b. Adaptive Passive Ceiling sensor, 450 sq. ft. ATP450C Series

D. Hubbell H-MOSS, or approved equal, Wall mount sensors provided in type as indicated on the plans

10. Adaptive Technology Dual Wall Mount Sensors.
    a. Adaptive Dual Wall Mount Sensors, 1600 sq. ft. ATD1600W Series
    b. Adaptive Passive Wall Mount Sensors, 450 sq. ft. ATD450W Series

E. Hubbell H-MOSS, or approved equal, Controls

11. Control units and add-a-relay.
    a. 120 V AC, for use with ATD, ATU and ATP series ceiling and wall mount sensors, CU120A
    b. 277V AC, for use type with ATD, ATU and ATP series ceiling sensors and wall

mount sensors

c. 120/277V AC, 50/60Hz for use with ATD, ATU and ATP series ceiling sensors and wall mount sensors

F. Passive infrared sensors shall utilize Pulse Count Processing and Detection Signature Processing to respond only to those signals caused by human motion.

G. Passive infrared sensors shall provide high immunity to false triggering from RFI (hand-held radios) and EMI

H. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.

I. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

J. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

K. All sensors shall be capable of operating normally with electronic ballasts.

L. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

M. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

N. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

O. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

P. All sensors shall have UL rated, 94V-0 plastic enclosures.

1.06 CIRCUIT CONTROL HARDWARE

A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.

B. Relay Contacts shall have ratings of:

12. 20A - 120 VAC Ballast

C. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #12 AWG.

PART 3 EXECUTION

1.07 INSTALLATION

A. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

B. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with specifications. The supplier’s obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

C. Delivery/installation of Lighting control Panels: The contractor is responsible for complete installation of the entire system according to strict factory standards and requirements. The following items shall constitute factory standards and requirements:

1. All system equipment shall operate in accordance with specification and industrial standard procedures.
2. An operational user program shall exist in the control system. The program shall execute and perform all functions required to effectively operate the site according to the requirements.
3. Demonstration of program integrity during normal operation and pursuant to a power outage.
4. Contractor shall provide a minimum of two training hours on the operation and use of the control system. Additional support services shall be negotiated between the contractor and the building owner or manager.

End of Section 26 09 39

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the panelboards as specified and scheduled on the plans.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification is Square D; Schneider and shall represent the minimum level of construction. Products manufactured by GE Electrical Distribution & Control, Eaton, and Siemens Energy & Automation, Inc.shall be permitted to bid these specifications.

B. AIC ratings shown for all equipment assume that system shall be fully rated. Series rated systems shall not be permitted without Engineer's prior approval.

C. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 120/208 VOLT PANELBOARDS

A. Provide the following Square D, type NQ, or approved equal, 3 phase, 4-wire panelboards with circuit breakers as scheduled.

B. Provide panels with ground bars, surface mounted cabinets and UL label.

C. Circuit breakers shall be Square D Type QO (plug-on) or QOB (bolt-on), or approved equal, thermal-magnetic molded case circuit breakers. Type QO-GFI ground fault breakers and QO-CAFI combination arc breakers shall be provided as indicated and required by the NEC. Breakers shall be 1, 2 or 3-pole with an integral crossbar to assure simultaneous opening of all poles in multi-pole circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON," "OFF" and "TRIPPED" positions. Plug-on (QO) and bolt-on (QOB) circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 240 volts ac maximum with continuous current ratings as noted on the plans. AFCI – Arc Fault breakers shall be provided for all circuits as required in section 210.12 of the NEC

D. Panelboard bus structure and main lugs or main circuit breaker current ratings as specified. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67. Bus structure shall be insulated. Bus bar connections to the branch circuit breakers shall be the "distributed phase" type and shall accept either plug-on (QO) on bolt-on (QOB) circuit breakers. All current carrying parts of the bus structure shall be plated.

E. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. Each front shall include a door and have a flush, cylinder tumbler-type lock with catch and spring-loaded stainless steel door pull. All panelboards' locks shall be keyed alike. Fronts shall have trim screws which shall be completely concealed when the doors are closed. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with door in the locked position. A circuit directory card with a clear plastic covering shall be provided on the inside of the door.

F. Where panelboard is indicated with main circuit breaker, provide Type HD breakers for 100 amp

panels (25 Kaic), provide Type JD breakers for 200 amp panels (25 Kaic), and Type LD breakers for 400 amp panels (25 Kaic), Panels shall be as indicated and scheduled on the plans.

G. Fault current ratings shall match panel schedules. Frame size and circuit breaker type to match fault current rating.

H. Surge Protective Devices – per the requirements in Section 26 43 13 where panels are indicated on drawings or scheduled to be provided with SPD (TVSS).

2.03 CIRCUIT BREAKER DISTRIBUTION PANELS

A. Provide the following Square D, type I-Line, or approved equal, 3 phase, 4-wire panelboards with circuit breakers as scheduled. Where applicable, panelboard shall be UL Listed for Service Entrance Equipment.

B. Provide panels with ground bars, surface mounted cabinets and UL label.

C. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. Endwalls shall be removable. Fronts shall be of code gauge steel. Gray baked enamel finish electrodeposited over cleaned phosphatized steel.

D. The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

E. Panelboard bus structure and main lugs or main breaker shall have current ratings as specified. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50° C. rise above ambient. Heat rise tests shall be conducted in accordance with UL Standard 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests.

F. Circuit breakers shall be Square D, Type FA or approved equal in 100 amp frames, Type HD in 150 amp frames, Type JD is 250 amp frames, and LD in 400 and 600 amp frames. All shall be thermal-magnetic, molded case circuit breakers with factory sealed trip units, unless scheduled otherwise. Breakers shall be 1, 2 or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breakers shall have an over-center, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated(1 pole FA, 15 to 100) with an interrupting rating as indicated on drawings/schedule with a minimum of 18 Kaic, (2 and 3 pole HD, 15-150 amps) with an interrupting rating as indicated on drawings/schedule with a minimum of 18 Kaic, (2 and 3 pole JD, 150 to 250 amps) with an interrupting rating of as indicated on drawings/schedule with a minimum rating of 18 Kaic, and , (2 and 3 pole LD, 250 to 600 amps) with an interrupting rating of as indicated on drawings/schedule with a minimum rating of 18 Kaic. Panels shall be as indicated and scheduled on the plans.

G. Fault current ratings shall match panel schedules. Frame size and circuit breaker type to match fault current rating.

H. Surge Protective Devices – per the requirements in Section 26 43 13 where panels are indicated on drawings or scheduled to be provided with SPD (TVSS).

End of Section 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the wiring devices cover plates, relays and contactors, time clocks, and photoelectric cell equipment as specified.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification is Hubbell and shall represent the minimum level of construction. Products manufactured by Pass and Seymour and Eagle shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 WIRING DEVICES

A. The following devices shall be as manufactured by Hubbell, or approved equal. They shall be rated at 20 amps, 120/277 volts, unless specified otherwise. Verify device color with architect before ordering.

B. Devices shall be as follows:

1. Switches:
   - a. S.P.S.T. — Hubbell CSB120
   - b. 2-pole switch — Hubbell CSB220
   - c. 3-way switch — Hubbell CSB320
   - d. 4-way switch — Hubbell CSB420
   - e. Keyed switch — Hubbell HBL1221L
   - f. 2-pole keyed switch — Hubbell HBL1222L
   - g. 3-way keyed switch — Hubbell HBL1223L
   - h. 4-way keyed switch — Hubbell HBL1224L
   - i. S.P.S.T. with pilot light — Hubbell HBL1221PL
   - j. Auto/Off switch — Hubbell CS1221
   - k. Chiller/Boiler/ Water Heater Emergency Shutdown switches — Square D KR9RH13
   - l. Chiller emergency Ventilation switch — Square D KR9RH13
2. General Wall Receptacles:
   - a. 120 volt duplex outlet — Hubbell CR5352AG
   - b. 120 volt duplex tamper resistant with dual USB — Hubbell USB20A5
   - c. Controlled — Hubbell BR20C2
   - d. Tamper resistant — Hubbell BR20TR
   - e. Isolated Ground outlet — Hubbell CR5352IG
   - f. Single outlet — Hubbell HBL5361
   - g. Drinking fountain/Vending — Hubbell GF20L
   - h. GFI outlet — Hubbell GF20L
   - i. Weatherproof outlet — Hubbell GFWRST20 with MM420C cover

j. Range Outlet (50 amp, 120/240) Hubbell RR450F /SS703 cover plate (NEMA 14-50)
k. Dryer Outlet (30 amp, 120/240) Hubbell RR430F w/SS703 cover plate (NEMA 14-30)

3. Hospital Grade Wall Receptacles:
   a. 120 volt duplex outlet Hubbell HBL8300
   b. 120 volt duplex tamper resistant with dual USB Hubbell USB8300A5
   c. Emergency 120 volt duplex Hubbell IG8300
   d. Single outlet Hubbell HBL8310
   e. GFI outlet Hubbell GF8300A
   f. Emergency GFI outlet Hubbell GF8300RA
4. General Wall Tamper-Resistant Receptacles (Dwelling Units):
   a. 120 volt duplex outlet Hubbell BR20TR
   b. Controlled Hubbell BR20C2TR
   c. Single outlet Hubbell RR201TR
   d. GFI outlet Hubbell GFTR20
   a. Weatherproof cover/GFI outlet Hubbell GFTWRST20 with MM420C cover
5. Floor Devices: first floor (slab on grade) only
   a. Duplex power Hubbell 3SFBC box with 3SFBC Cover, 2-3SFBRP receptacle plates, 2- Hubbell CR5352AG or IG.
   b. Power/Telephone-Data Hubbell 3SFBC box with 3SFBC cover, 3SFBRP receptacle plate, 3SFBTP for telephone-data, Hubbell CR5352AG or IG.
6. Floor Devices: (poke-through)
   a. Duplex power Hubbell Flush Series Fire rated “Poke-Thru” with FRF service fitting & PT7FSD-GXA through-floor fitting
   b. Isolated Ground power Hubbell Flush Series Fire rated “Poke-Thru”, PT7IGFSD complete with though-floor fitting, service fitting and IG receptacle
   b. Power/Telephone-Data Hubbell Flush Series Fire rated “Poke-Thru” with PT2X2 service fitting & PT2X2FIT through-floor fitting

c. Multi-Outlet Wall and Floor Boxes:
   - Type A: Hubbell HBLWSCS2, two gang box with HBLSCSBW barriers as required for voltage separation. Provide HBLST302S duplex face plates for receptacles and HBLBL300S blank plates for CATV and data/phone outlets. Provide HBLTRIM2W wall flange. Provide receptacles as indicated on plans and described above.
   - Type A: (Installation in Masonry) Hubbell HBLWSCS2MBD, two gang box with all accessories above.Use HBLSCSBMBD barriers where required for voltage separation.
   - Type B: Hubbell HBLWSCS3, three gang box with HBLSCSBW barriers as required for voltage separation. Provide HBLST302S duplex face plates for receptacles and HBLBL300S blank plates for CATV and data/phone outlets. Provide HBLTRIM3W wall flange. Provide receptacles as indicated on plans and described above.

- Type B: (Installation in Masonry) Hubbell HBLWSC3MBD, three gang box with all accessories above.Use HBLSCSBMBD barriers where required for voltage separation.
- Type C: Hubbell HBLWSCS4, four gang box with HBLSCSBW barriers as required for voltage separation. Provide HBLST302S duplex face plates for receptacles and HBLBL300S blank plates for CATV, data/phone outlets, and spare gang. Provide HBLTRIM4W wall flange. Provide receptacles as indicated on plans and described above.
- Type C: (Installation in Masonry) Hubbell HBLWSCS4MBD, four gang box with all accessories above.Use HBLSCSBMBD barriers where required for voltage separation.
- Type D: Hubbell HBLWSCS6, six gang box with HBLSCSBW barriers as required for voltage separation. Provide HBLST302S duplex face plates for receptacles and HBLBL300S blank plates for CATV, data/phone outlets and spare gang. Provide HBLTRIM6W wall flange.
- Type D: (Installation in Masonry) Hubbell HBLWSCS6MBD, six gang box with all accessories above. Use HBLSCSBMBD barriers where required for voltage separation.
- Type E: (Floor) Hubbell HBLCFB301BASE, stamped steel deep 4-gang box with HBLTCGNTSW cover/flange assembly. Provide HBLST302SGY duplex face plates for receptacles and HBLBL300SGY blank plates for CATV and data/phone outlets.
- Type F: (Floor) Hubbell HBLCFB501BASE, stamped steel deep 8-gang box with HBLTCGNTSW cover/flange assembly. Provide HBLST302SGY duplex face plates for receptacles and HBLBL300SGY blank plates for CATV and data/phone outlets and spare gangs.

2.03 COVER PLATES

A. All flush-mounted wiring devices shall be provided with Hubbell SS Series Stainless Steel plates in the configuration and number of gangs as required.

B. Cover plates for wiring devices in surface-mounted boxes shall be galvanized utility box covers, raised 1/4“.

C. Where more than one device is in a single location, a one-piece multi-gang cover plate shall be used.

D. All cover plates for switches controlling mechanical equipment and where indicated on the drawings, shall be stainless steel with standard 1/8" high engraved characters and black filler.

E. All cover plates for receptacles in hospitals shall be engraved with the panelboard and circuit number serving the device.

2.04 CEILING RECEPTACLE/OUTLET CORD SETS

B. Each 120 volt ceiling receptacle indicated on the plans shall be safety-shroud, 20 amp twist lock type, Hubbel model L5-20R, and shall be provided with a ceiling outlet cord set. Cord set shall be comprised of HubbellHBL2311S plug, or approved equal, 6'-0" of 3-12 type SJO cord with strain relief at plug and box, Woodhead 3083-3, or approved equal, outlet box with coverplates, and two Hubbell GFR5352A, or approved equal, devices.

2.05 RELAYS AND CONTACTORS

A. Provide Square D and ECG Phillips, or approved equal, I.T.E., Zenith or ASCO, relays and contactors as shown on the plans.

2.06 TIME CLOCKS

A. Time clocks shall be EZ Controls, or approved equal Paragon or Intermatic, Model EZ-701-2, 2PST, or approved equal, maintained contact time switch with 25 amp rated controls.

B. Time clocks shall be based on solid state technology with 10-year memory retention and rechargeable battery carryover.

2.07 PHOTOELECTRIC CELL

A. Provide an Intermatic, or approved equal, model #K4021, 120 volt, 1800 watt photoelectric cell.

PART 3 EXECUTION

3.01 DEVICE ELEVATIONS

A. Devices shall be set at the following elevations from the finished floor to the top of the box, unless otherwise indicated on the plans:

1. Light switches 48"
2. Control switches 48"
3. Thermostats 48"
4. Telephone outlets 16" Btm
5. Convenience receptacles 16" Btm
6. Isolated Ground receptacles 16” Btm
7. Drinking fountain receptacles As required by manufacturer
8. Fire alarm break glass stations 48"
9. Fire alarm A/V units Btm at 80"

B. Boxes for wall mounted light fixtures shall be at elevations noted on the plans.

C. Tamper resistant receptacles shall be provided at all locations as required by Section 406.11 (dwelling units) and Section 517 (pediatric areas) of the latest adopted version of the NEC

D. Ground fault interrupter receptacles shall be provided in all locations as required in Section 210.8 of the latest adopted version of the NEC

End of Section 26 27 26

SECTION 26 28 16 - SAFETY SWITCHES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide heavy-duty safety switches as indicated on the plans and as specified. All safety switches shall be NEMA Type HD and Underwriters Laboratories listed.

PART 2 PRODUCTS

3.02 APPROVED MANUFACTURERS

A. The basis for this specification is Square D; Groupe Schneider and shall represent the minimum level of construction. Products manufactured by GE Electrical Distribution & Control, Eaton, and Siemens Energy & Automation, Inc. shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 SAFETY SWITCHES

A. Provide Square D, or approved equal, heavy duty grade safety switches in configuration noted.

B. All switches shall have switchblades, which are fully visible in the "OFF" position when the switch door is open. All current carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have removable arc suppressors where necessary to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60° C or 75° C aluminum or copper wires.

C. Switches shall be quick-make, quick-break, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The operating handle shall be an integral part of the box, not the cover. Provisions for padlocking the switch in the "OFF" position with at least three locks shall be provided. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. The handle position shall indicate whether the switch is "ON" or "OFF."

D. Switches shall be furnished in NEMA 1 heavy duty enclosures unless specified as NEMA 3R on the plans. Covers on NEMA 1 enclosures shall be attached with pin type hinges. NEMA 3R covers shall be securable in the open position. NEMA 3R enclosures for switches through 200 amps shall have provisions for interchangeable bolt-on hubs. Hubs shall be as indicated on the plans. NEMA 3R enclosures shall be manufactured from galvanized steel. Enclosures shall have a gray baked-enamel finish, electrodeposited on cleaned, phosphatized steel.

E. All fusible switches rated 100 through 600 amps at 240 volts and 30 through 600 amps at 600 volts, shall have a UL approved method of field conversion from standard Class H fuse spacing to Class J fuse spacing. The switch also must accept Class R fuses and have provisions for field installation of a UL listed rejection feature to reject all fuses except Class R. The UL listed short circuit rating of the switches shall be 200,000 rms symmetrical amps when Class R or Class J fuses are used with the appropriate rejection scheme. 800 and 1200 amp switches shall have provisions for Class L fuses and shall have a UL listed short circuit rating of 200,000 rms symmetrical amps.

PART 3 EXECUTION

End of Section 26 28 16

SECTION 26 41 13 - LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. A system of lightning protection shall be provided and installed in compliance with the provisions of the latest "Code for Protection Against Lightning" for buildings as adopted by the National Fire Protection Association (NFPA 780) and the Underwriters' Laboratories, Inc. (UL Standard 96A) for a Master Label System.

B. If any departures from the contract documents are deemed necessary by the contractor, details of such departures and the reasons therefore shall be submitted as soon as practicable to the engineer for approval. No such departures shall be made without the prior written approval of the engineer. Also, the lightning protection system shall be installed by a lightning protection contractor who specializes in this field.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification is Preferred Lightning Protection of Maryville, Missouri, 64468 and shall represent the minimum level of construction. Products manufactured by Erico, Inc., Heary Brothers Lightning Protection Co., Inc. and Thompson Lightning Protection, Inc. shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 LIGHTNING PROTECTION EQUIPMENT

A. All material shall comply in weight, size and composition with the requirements of the Underwriters' Laboratories, Inc., and the National Fire Protection Association Code relating to this type of structure.

B. Air terminals shall be 1/2" x 18" solid aluminum and shall extend at least 18" above the object to be protected. All air terminal bases shall be cast aluminum with stainless steel bolt-pressure cable connectors. The air terminals should be spaced so as not to exceed 20' apart around the outside perimeter of the roof or the ridge, and not over 50' apart through the center of flat roof areas. The air terminals in the center roof area shall be 1/2" x 24" solid aluminum with a proper brace. All air terminal bases for flat roof areas shall be of the adhesive type.

C. Conductors shall consist of UL listed 28 strands of 14 gauge aluminum wire weighing 114 lbs. per 1000' and installed in accordance with the UL Code. A perimeter cable shall be installed around the entire main roof, and all penthouses. Each perimeter cable shall be connected to at least (2) down leads, providing a two way path to ground from each air terminal. All center roof air terminals shall be interconnected with conductors to the outside perimeter cable. Conductors on the flat roof areas may be run exposed. Ground connections shall be made around the perimeter of each roof and to the main down conductor.

D. Conductor fasteners shall be an approved type of non-corrosive metal, have ample strength to support conductors and shall be spaced not to exceed 3-0" centers. Masonry type cable fasteners spaced every 3'-0" on masonry. Adhesive type cable fasteners spaced every 3'-0" on flat roofs.

E. Wherever the conduit penetrates the roof, pipe flashings shall be furnished by the lightning protection contractor and installed by the roofing contractor (pitch pockets will not be accepted).

All patching and masonry work shall be furnished and installed by the general contractor.

F. Each perimeter roof cable shall be connected to at least 2 down leads. The average distance between down leads shall not exceed 100' from upper roof to lower roof, or from roof to ground terminals. Irregularly shaped structures may require extra down conductors to provide a two way path to ground from each air terminal.

G. All cable connectors shall be cast aluminum with screw-pressure type stainless steel bolts and nuts.

H. All metal bodies within 6' of the conductor shall be bonded to the system with approved fittings and conductor. Connections between dissimilar metals shall be made with approved bimetallic connections. Bonding of all metallic objects and systems at roof levels and elsewhere on the structure shall be complete. Primary bonds for metal bodies of conductance shall be bonded with appropriate fittings and full-sized conductor, and shall consist of, but not limited to the following: roof exhaust fans, HVAC units with related ductwork, exhaust vents and any other roof piping systems, radio or microwave dishes, roof ladders, metal plumbing stacks, etc. Exterior architectural metal fascia and/or curtain walls or mullions, which extend the full height of the structure shall also be bonded, if not inherently bonded through the building frame.

I. Grounding terminals shall be located at the base of the structure. Ground connections shall be made around the perimeter of the structure and in no case shall average over 100'-0" apart. Ground terminals shall be 3/4" in diameter and shall be driven to a minimum depth of 10' and more if necessary to reach permanent moisture. In case of rock ledge or other conditions making it impossible to comply with the above, trenching or a copper ground plate will be permitted, providing it will meet the Underwriters' Laboratories, Inc., requirements.

PART 3 EXECUTION

3.01 EXCAVATION

A. All services involving excavating, trenching, back filling, tamping of ground for ground rods, test wells and ground loops, shall be furnished and completed by the electrical contractor and meet the architect's and engineer's requirements.

3.02 MASTER LABEL

A. A certified letter shall be furnished as evidence that the installation has met with UL Standard 96A code requirements. Shop drawings in detail and catalog cuts shall be submitted for approval by the architect and engineer prior to installation of the system.

End of Section 26 41 13

SECTION 26 43 13 –SURGE PROTECTIVE DEVICES (TRANSIENT VOLTAGE SURGE SUPPRESSOR)

PART 1 GENERAL

1.01 MAIN SERVICE PANELBOARDS

A. These specifications describe the electrical and mechanical requirements for a high energy surge protective device system (abbreviated as TVSS or SPD in this specification and on all drawings). The specified system shall provide effective high energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Type 2 environments, as tested by ANSI/IEEE C62.45. The system shall be connected in parallel with the protected system; no series connected elements shall be used, which could constitute a single point failure.

1.02 BRANCH PANEL DEVICES (SEPARATE DEVICE)

A. These specifications describe the electrical and mechanical requirements for a high energy surge protective device system (abbreviated as TVSS or SPD in this specification and on all drawings). The specified system shall provide effective high energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Type 2, as tested by ANSI/IEEE C62.45. The system shall be connected in parallel with the protected system; no series connected elements shall be used, which could constitute a single point failure.

1.03 STANDARDS

A. The specified system shall be designed, manufactured, tested and installed in compliance with:

1. Canadian Standards Association (CSA)
2. American National Standards Institute C62.41
3. Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.1, C62.41, and C62.45)
4. Federal Information Processing Standards Publication 94 (FIPS PUB 94)
5. National Electrical Manufacturer Association (NEMA) LSI-1992 Guidelines
6. National Fire Protection Association (NFPA 20, 70, 75, and 78)
7. Underwriters Laboratories (UL Standard 1449, UL Standard 1283)
8. National Electrical Code – Article 285

B. The system shall be UL listed as a complete system under UL 1449 Standard for Surge Protection Devices, Third Edition or Newer.

1.04 DESCRIPTION

A. Provide Type 2 Surge Protection Devices (SPD) for the protection of AC electrical circuits formerly knows as Transient Voltage Surge Suppression (TVSS) system. Provide high energy surge current diversion and be suitable for application in type 2 environments.

B. Modes of Protection:

1. Line to Ground, Line to Neutral and neutral to Ground for services with a neutral.
2. For Services without a neutral, Line to Line and Line to Ground.

C. Provide common and normal modes of protection.

1.05 QUALITY ASSURANCE

A. The specified system shall be thoroughly factory-tested before shipment. Testing of each system shall include but shall not be limited to quality control checks, "Hi-Pot" tests at two times rated voltage plus 1000 volts per UL requirements, IEEE C62.41 Category B surge tests, UL ground leakage tests and operational and calibration tests.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Acceptable manufacturers:

1. APT
2. Hubbell
3. Current Technology
4. Liebert
5. Raycap

B. The basis for separately mounted units is Hubbell SPD and shall represent the minimum level of construction. The basis for separately mounted units is Hubbell SPD and shall represent the minimum level of construction. Products manufactured by Eaton and Square D shall be permitted to bid these specifications.

C. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 PERFORMANCE CHARACTERISTICS

A. Response time: > 5 nanosections for all modes of protection.

B. SPD shall bear the UL Mark and shall be Listed to third Edition of UL 1449. "Manufactured in accordance with" is not equivalent to UL Listing and does not meet intent of specification.

C. Post SPD and performance parameters at www.UL.com under Category Code: VZCA. Products or parmeter without posting at UL.com are not approved.

D. Minimum surge current capacity for Service Entrance units based on 8 x 20 microsecond current waveform:

1. 200,000 amps between each phase for line-to-line mode
2. 200,000 amps each phase for line-to-ground mode
3. 200,000 amps each phase for line-to-neutral mode
4. 200,000 amps for neutral-to-ground mode

E. Minimum surge current capacity for panelboard units based on 8 x 20 microsecond current waveform:

1. 100,000 amps between each phase for line-to-line mode
2. 100,000 amps each phase for line-to-ground mode
3. 100,000 amps each phase for line-to-neutral mode
4. 100,000 amps for neutral-to-ground mode

F. Sequential Surge Current Survivability:

1. 1,000 sequential category surges without failure.

G. Current Rating:

1. Rated for continuous current and AIC rating of equipment protected.

2.03 OPERATING CONDITIONS

A. Temperature range: -40°C to +50°C (-40°F to 122°F).

B. Relative humidity range: 0 to 95%, non-condensing.

C. Audible noise level: > 40 dBA at 5 ft.

2.04 SPD FABRICATION:

A. SPD Modules:

1. UL Labeled as Type 2 (verifiable at www.UL.com), intended for use without need for external or supplemental overcurrent controls. Protect suppression component of every mode, including N-G, by internal overcurrent and thermal overtemperature controls. SPDs relying on external or supplementary installed safety disconnects do not meet the intent of specifications.
2. Ul Labeled with 20kA I-nominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
3. Suppression components: Heavy-duty MOVs, selenium cells, or combination of both.
4. Provide surge current diversion paths for all modes of protect: L-N, L-G, N-G in Wye systems, and L-L, L-G in delta systems.
5. Provide service entrance SPD audible diagnostic monitoring by way of audible alarm.
6. Provide service entrance SPD with 1 set of NO/NC dry contacts for alarm conditions.
7. Provide visual LED diagnostics including a minimum of 1 green LED indicator per phase, and 1 red service LED. Include an audible alarm with on/off silence function and diagnostics test function (excluding branch).
8. If a dedicated breaker for the SPD is not provide in the switchboard, include an integral UL Recognized disconnect switch. Dedicated breaker to serve as means for disconnect for distribution SPDs.
9. Meet or exceed the following criteria:
   a. UL 1449 Listed Voltage Protection Ratings (VPRs) for 6kV 3000A testing as follows:

Voltage	L-N, L-G, N-G	L-L
208Y/120V	650-800V	650-800V
480Y/277V	1100-1300V	1900-2100V

   b. UL 1440 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120V	15%	140V
480Y/277V	15%	320V

   c. Provide a serviceable, replaceable modules (excluding Branch).
   d. Provide warranty for a period of 10 years, incorporating unlimited replacement of suppressor parts if they are destroyed by transients during the warranty period.

B. Service Entrance:

1. Install 1 primary suppressor external to the service entrance in accordance with manufacturer instructions.
2. Install SPD on line or load side.
3. Bond SPD ground to service entrance ground.

C. SPD Performance Interconnect Cable (DPI):

1. Provide dual-shielded triple insulated multi-core power conductor cable specifically listed for SPD installations.
2. Provide Low impedance approximately 25% of conventional pipe and wire for improved clamping voltage.

PART 3 EXECUTION

3.01 APPLICATION OF SPD

A. Provide UL-approved disconnect switch at Service Entrance or Transfer Switch as a means of service disconnect if a 60A breaker is not available.

B. Provide independent means of servicing disconnect at Branch Panelboards such that the protected panel remains energized. A 30A breaker (or larger) may serve this function (for non-integral TVSS panelboards).

3.02 INSTALLATION

A. Installation shall be in strict accordance with manufacturer's recommendations.

B. Unit shall be installed within 2'-0" of panel with straight wiring connection. Manufacturer-approved cables may be used that allow conductor length to extend beyond 2’-0” in length without affecting capability of unit.

C. Input conductors twisted together to reduce inductance.

D. Avoid 90-degree bends in cable.

3.03 QUALITY ASSURANCE

A. Factory test system prior to shipment. Include quality control check, “Hi-Pot” test at 2 times rated voltage plus 1,000 volts, ground leakage tests, and calibration.

3.04 WARRANTY

A. Provide 10-year manufacturer warranty.

End of Section 26 43 13

SECTION 26 51 13 – INTERIOR LIGHTING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the light fixtures as specified. Material, equipment or services necessary to complete the installation of these fixtures, but not specifically mentioned shall be furnished as though specified.

B. It shall be the duty of the Contractor to check the following fixtures carefully against the wiring plans, and furnish a unit of proper size and type.

C. The manufacturer and number listed in these specifications establish type and quality. Fixtures of similar manufacturer must be pre-approved by the Engineer/Lighting Designer prior to bidding.

D. The contractor shall provide a Lighting control System including lamps/ballasts that meets all performance requirements in accordance with approved plans and specifications.

E. The "Lighting control system" as referred to in this section of the specifications shall include the following subsystems and components of the subsystems: occupancy sensors, time sweep controls, daylighting controls, architectural dimming controls, and lamps/ballasts.

1.02 LED DRIVER WARRANTY

A. Electronic drivers shall be provided with a 5-year warranty. If the driver fails within the warranty period, the driver manufacturer will provide replacement driver free of charge and shall provide a labor allowance to cover the cost of driver installation. This warranty shall be provided direct to the Owner.

1.03 FIXTURE PACKAGING

A. Packaging of fixtures for the purpose of reducing cost or reducing the burden on manufacturer's agents, distributors, or contractors shall not be permitted. Contractor shall obtain from manufacturer and distributor unit pricing for each fixture for inspection by Engineer/Lighting Designer. Failure to comply with written specifications shall hold the contractor financially responsible for providing specified fixtures to the Project.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Light fixtures shall be as scheduled on plans. Equivalent light fixtures from Hubbell, Kim Lighting, Lithonia shall be allowed as equal.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 LAMPS

A. Lamps shall be provided by the electrical contractor with sizes as indicated on the drawings. Lamps shall be as manufactured by Philips Lighting Company or approved equal Sylvania or General Electric.

B. **Light Emitting Diode (LED) lamps** shall be provided as listed below:

1. White LED fixtures for general illumination shall have been tested by the US Department of Energy's CALiPER Program.
2. Tested to IES TM-30-15 standards.
3. Color Temperature: No greater than 4000k for indoor illumination unless scheduled

otherwise.

4. LED replacement tubes for fluorescent lighting are not allowed.
5. All LED luminaires shall have been designed around the LED Source. LED Lamps marketed as replacements for fluorescent fixtures are not permitted.
6. LED System shall be modular and allow for separate replacement of LEDs and drivers.

2.03 LED DRIVERS

A. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and compliant with NEMA SSL 1 “Electronic Drivers for LED Devices, Arrays, or Systems.” LED Drivers shall have a sound rating of “A”, have a minimum efficiency of 85%, and be rated for a THD of less than 20% at all input voltages.

B. **Dimmable LED drivers shall be 0-10V type** shall be capable of dimming without LED strobing or flicker across their full dimming range.

C. **Interior Emergency LED drivers** shall be provided as noted in the Light Fixture Schedule.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install light fixtures at locations and heights as indicated and in accordance with fixture manufacturer's instructions.

B. Install fixtures as recommended by the manufacturer, or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection, or angular jointing of fixtures suspended in continuous rows.

C. Where surface mounted fixtures are indicated for installation on ceilings made of combustible materials, provide 1½" ceiling spacers, unless the fixture is UL approved for mounting directly to the ceiling material.

D. Properly support and align all fixtures and provide all necessary steel shapes for support of the fixtures. Fixtures recessed in ceilings shall be securely connected to the ceiling. For fixtures weighing less than 56 pounds, provide a minimum of two (2) 12 gauge wires which are connected to the structure above. These wires are to be extended and attached to the light fixture and may be slack. Fixtures weighing more than 56 pounds shall be supported directly from the structure above. Coordinate complete fixture installation with the building construction.

E. Where units are shown installed end to end, provide suitable connectors or collars to connect adjoining units to appear as a continuous unit.

A. All fixtures shall be provided with T-bar clips, snap on type. Manufacturers with integral clips, in compliance with National Electrical Code requirements, will be acceptable.

3.03 COORDINATION

A. Refer to Architectural drawings for exact fixture locations.

B. Coordinate the installation and location of light fixtures with other work and all other trades before installation to avoid conflicts. Light fixture locations in mechanical rooms shall be coordinated with final installed piping and ductwork layouts.

C. Unless otherwise indicated, square and rectangular fixtures shall be mounted with sides parallel to building and ceiling lines.

D. Verify all ceiling systems and coordinate fixture type and accessories prior to ordering fixtures. Coordinate and cooperate with ceiling installer in regards to the location and installation of light fixtures.

3.04 WALL MOUNTED FIXTURES

A. All wall mounted fixtures shall be coordinated with the architectural features of the building. Where specific elevations or dimensions are not indicated, verify the correct location with the Architect prior to beginning any work.

B. Unless otherwise noted, all conduit and back boxes for wall mounted fixtures shall be concealed.

3.05 ADJUSTING

A. Adjust all fixture sockets to match the lamp specified and aim all adjustable fixtures as directed by the Architect.

B. Upon completion of the installation of light fixtures, and after building circuits have been energized, apply electrical energy to demonstrate capability and compliance with the requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

C. Clean light fixtures of dirt and debris upon completion of the installation. Protect installed fixtures from damage during the remainder of the construction period.

D. At the time of substantial completion, aim all track lights, flood lights, spot lights, etc per the Architect's direction. Provide all scaffolds, lifts etc as required.

E. At the time of final acceptance of this project by the Owner, all lamps shall be in working order and all fixtures shall be fully lamped.

End of Section 26 51 13

SECTION 26 56 13 – EXTERIOR LIGHTING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the light fixtures as specified. Material, equipment or services necessary to complete the installation of these fixtures, but not specifically mentioned shall be furnished as though specified.

B. It shall be the duty of the Contractor to check the following fixtures carefully against the wiring plans, and furnish a unit of proper size and type.

C. The manufacturer and number listed in these specifications establish type and quality. Fixtures of similar manufacturer must be pre-approved by the Engineer/Lighting Designer prior to bidding.

D. The contractor shall provide a Lighting control System including lamps/drivers/ballasts that meets all performance requirements in accordance with approved plans and specifications.

E. The “Lighting control system” as referred to in this section of the specifications shall include the following subsystems and components of the subsystems: occupancy sensors, time sweep controls, daylighting controls, architectural dimming controls, and lamps/ballasts.

1.02 LED DRIVER WARRANTY

A. Electronic drivers shall be provided with a 3-year warranty. If the driver fails within the warranty period, the driver manufacturer will provide replacement driver free of charge and shall provide a labor allowance to cover the cost of driver installation. This warranty shall be provided direct to the Owner.

1.03 FIXTURE PACKAGING

A. Packaging of fixtures for the purpose of reducing cost or reducing the burden on manufacturer’s agents, distributors, or contractors shall not be permitted. Contractor shall obtain from manufacturer and distributor unit pricing for each fixture for inspection by Engineer/Lighting Designer. Failure to comply with written specifications shall hold the contractor financially responsible for providing specified fixtures to the Project.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Light fixtures shall be as scheduled on plans. Equivalent light fixtures from Hubbell, Kim Lighting, Lithonia shall be allowed as equal.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 LAMPS

A. Lamps shall be provided by the electrical contractor with sizes as indicated.

B. All Light Emitting Diode (LED) lamps shall be provided as listed below:

1. White LED fixtures for general illumination shall have been tested by the US Department of Energy’s CALiPER Program
2. Color Temperature: No greater than 4000k for indoor illumination unless

scheduled otherwise.

3. All LED luminaires shall have been designed around the LED Source. LED Lamps marketed as replacements for fluorescent fixtures are not permitted.
4. LED System shall be modular and allow for separate replacement of LEDs and drivers.

1.01 LED DRIVERS

C. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 18, and compliant with NEMA SSL 1 “Electronic Drivers for LED Devices, Arrays, or Systems.” LED Drivers shall have a sound rating of “A”, have a minimum efficiency of 85%, be rated for a THD of less than 20% at all input voltages, and rated for temperatures from -40° F to 120° F.

A. POWER SUPPLIES: CLASS I OR II OUTPUT

B. **DIMMABLE LED DRIVERS SHALL BE 0-10V TYPE** SHALL BE CAPABLE OF DIMMING WITHOUT LED STROBING OR FLICKER ACROSS THEIR FULL DIMMING RANGE.

C. **INTERIOR EMERGENCY LED DRIVERS** SHALL BE PROVIDED AS NOTED IN THE LIGHT FIXTURE SCHEDULE.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install light fixtures at locations and heights as indicated and in accordance with fixture manufacturer's instructions.

B. Install fixtures as recommended by the manufacturer, or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection, or angular jointing of fixtures suspended in continuous rows.

C. Where surface mounted fixtures are indicated for installation on ceilings made of combustible materials, provide 1½" ceiling spacers, unless the fixture is UL approved for mounting directly to the ceiling material.

D. Properly support and align all fixtures and provide all necessary steel shapes for support of the fixtures. Fixtures recessed in ceilings shall be securely connected to the ceiling. For fixtures weighing less than 56 pounds, provide a minimum of two (2) 12 gauge wires which are connected to the structure above. These wires are to be extended and attached to the light fixture and may be slack. Fixtures weighing more than 56 pounds shall be supported directly from the structure above. Coordinate complete fixture installation with the building construction.

A. All fixtures shall be provided with T-bar clips, snap on type. Manufacturers with integral clips, in compliance with National Electrical Code requirements, will be acceptable.

3.02 COORDINATION

A. Refer to Architectural drawings for exact fixture locations.

B. Coordinate the installation and location of light fixtures with other work and all other trades before installation to avoid conflicts.

C. Unless otherwise indicated, square and rectangular fixtures shall be mounted with sides parallel to building and ceiling lines.

D. Verify all ceiling systems and coordinate fixture type and accessories prior to ordering fixtures. Coordinate and cooperate with ceiling installer in regards to the location and

installation of light fixtures.

3.03 WALL MOUNTED FIXTURES

A. All wall mounted fixtures shall be coordinated with the architectural features of the building. Where specific elevations or dimensions are not indicated, verify the correct location with the Architect prior to beginning any work.

B. Unless otherwise noted, all conduit and back boxes for wall mounted fixtures shall be concealed.

3.04 POLE MOUNTED FIXTURES

A. The General Contractor shall provide concrete bases for pole mounted fixtures as detailed on the drawings and specified herein. The Electrical Contractor shall be responsible for coordinating their locations and for setting the anchor bolts and conduit. Concrete for pole bases shall be 3000 psi.

B. Provide anchor bolts of the size and orientation recommended by the manufacturer. The recommendations of the manufacturer shall govern the installation of all anchor bolts irrespective of any conflicting information.

C. Where conductors are strung within poles, they shall be installed so that conductor insulation will not wear by virtue of pole movement caused by wind or similar action. Consult the pole manufacturer for recommendations. Provide vertical support of conductors inside the pole as required by code.

D. A driven ground rod shall be installed at each pole location. Connect a bare grounding conductor to the pole grounding lug and the driven ground rod.

3.05 ADJUSTING

A. Adjust all fixture sockets to match the lamp specified and aim all adjustable fixtures as directed by the Architect.

B. Upon completion of the installation of light fixtures, and after building circuits have been energized, apply electrical energy to demonstrate capability and compliance with the requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

C. Clean light fixtures of dirt and debris upon completion of the installation. Protect installed fixtures from damage during the remainder of the construction period.

D. At the time of substantial completion, aim all flood lights, spot lights, etc per the Architect’s direction. Provide all scaffolds, lifts etc as required.

E. At the time of final acceptance of this project by the Owner, all lamps shall be in working order and all fixtures shall be fully lamped.

End of Section 26 56 13

SECTION 27 01 00 - GENERAL COMMUNICATIONS REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, General Requirements (Division 1), and Section 23 05 13 - ELECTRICAL PROVISIONS OF HVAC WORK, Section 22 05 13 – ELECTRICAL PROVISIONS OF PLUMBING, and Section 21 05 13 – ELECTRICAL PROVISIONS OF FIRE PROTECTION apply to the work specified in Division 26 - ELECTRICAL.

B. Refer to section 26 – Electrical specifications for expectations of communications related equipment and installation not provided in following communications specifications.

1.02 DESCRIPTION OF WORK

A. The Electrical Contract includes all labor, material, and equipment required for the complete electrical systems as shown and specified.

1.03 QUALITY ASSURANCE

A. Upon contract completion, the contractor will schedule a site survey with the J6/DOIM POC. The J6/DOIM appointed representative will validate the contractor's work and compliance with this statement of work prior to payment authorization.

1. POC list for this project:
   Onsite: Jeremy Newton
   (573) 690-1416

2. Offsite:
   J6/DOIM: Mitch Simpson
   (573) 638-9500 ext 37603

B. Each major component of equipment shall have the manufacturer's name, address, model number, rating, and UL label securely affixed in a conspicuous place.

C. All equipment of one type shall be the product of one manufacturer, unless specified otherwise.

D. In the event of discrepancies between the drawings and specifications, the contractor shall advise the engineer before proceeding with the work in order that correct progress is ensued.

E. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel." Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 SHOP DRAWINGS AND SUBMITTALS

A. Shop drawings shall be submitted as specified in Division 1. Product data shall be submitted for all materials and equipment specified in DIVISION 23. Shop drawings and submittals must be submitted in PDF format and emailed to the design team.

B. Shop drawings for equipment 'Packages" shall be complete and include all items to be provided by a manufacturer's representative or supply house. No partial submittals will be reviewed or approved without a complete and total equipment submittal.

C. Each shop drawing shall include a letter indicating all deviations from the drawings and/or specifications.

D. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:

1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
2. Capacity, pressure drop, rpm, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
3. Dimensional drawings showing layout, connection points, and detailed layout of components.
4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.
5. Conspicuously mark on each submittal the exact model, fittings, accessories, and devices to be supplied. When a schedule is shown on the drawings or in the specifications, provide a copy of that schedule with the shop drawing indicating the equipment capacities and characteristics of the actual equipment being proposed.
6. Tags for equipment submitted shall match the tags indicated on the design drawings or specifications. Where equipment is noted on the drawings and not scheduled, refer to plan note and sheet number on the submittal.

E. Contractor shall check all shop drawings to verify that they meet the requirements of the drawings and specifications before forwarding to the architect and engineer. All shop drawings submitted shall bear the stamp of the contractor to show that they have been reviewed in detail.

F. No work shall be fabricated and no equipment ordered until the architect and engineer have returned acceptable reviewed shop drawings.

G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this section.

1.05 PROJECT SEQUENCING

A. The contractor will coordinate site visits and work schedules in advance with both the J6/DOIM and site POCs.

B. The contractor will perform a site survey with the on or offsite POC to validate the summary of work as stated in section 3 of this document.

C. The contractor shall refer to the architectural plans and specifications for areas of work and general schedules to determine the scope of work required during each phase of the construction.

D. All temporary equipment, etc. not indicated, but required by phasing, shall be included in the base bid.

1.06 SUBSTITUTIONS

A. The materials, products, and equipment described by the Construction Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. Listing of these manufacturers shall in no way be construed as a device intended to limit the bidders to those specifically listed.

B. Reference to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number, shall be interpreted as having established a standard of quality and shall not be construed as limiting competition. Articles, fixtures, etc. of equal quality by manufacturers listed in this specification for the applicable use, shall be acceptable, subject to spatial, structural, and electrical constraints of the project design.

C. The Engineer reserves last opinion as to a product's equality or superiority to that specified.

1.07 DEFINITIONS

A. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

B. Install: The term "install" is used to describe operations at the project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

C. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

D. Furnished by Owner or Furnished by Others: The item will be furnished by the Owner or Others. It is to be installed and connected under the requirements of this Division, complete and ready for operation, including all items incidental to the Work, including all services necessary for proper installation and operation. The Installation shall be included under the guarantee required by this Division.

E. The design engineer, referred to as "engineer" shall mean the engineering firm, HOSS & BROWN ENGINEERS, INC., Contact person: Brandon Frey

1.08 OPERATION AND MAINTENANCE MANUALS

A. Three (3) Flash Drives containing PDFs of Operation and Maintenance (O&M) Manuals shall be submitted as described below. Files and folder names shall be clearly labeled. Folder structure and names shall be intuitive and clearly labeled.

B. Before project close-out, submit O&M operating, maintenance instructions, and parts lists for equipment provided. Include in the manual a list of emergency service organizations capable of rendering service for each piece of equipment.

C. Keep in a safe place all keys, wrenches, and other specialty tools furnished with equipment. Present to owner at project close-out and receive a receipt showing he has received the same.

D. At the completion of the project furnish to the Architect for the Owner O&M brochures divided and tabbed, containing all data, diagrams, capacities, spare part numbers, manufacturers service and maintenance data, warranties, guarantees, etc., including local contacts and escalation schedule complete with addresses and telephone numbers, of all equipment, apparatus, and system components furnished and installed under this Division of the specifications.

1.09 CODES AND ORDINANCES

A. All work shall be in accordance with applicable codes, rules, ordinances, and regulations of local, state, and federal governments and other authorities having jurisdiction.

B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard, to any ordinances, laws, codes, rules, or regulations bearing on work, the contractor shall execute work in accordance with such without increased cost to the owner, but not until he has referred such variances to the engineer.

C. The contractors shall secure and pay for the necessary permits and certificates of inspection for their trade. Keep record of all permits and inspections and submit two copies to the engineer with request for final inspection.

1.10 OWNER TRAINING

A. Contractor shall demonstrate to the owner that all mechanical systems installed under this division of the specifications are complete and operating as intended. Contractor shall provide documentation to owner of owner training.

B. Any adjustments or other additional work required as a result of failure of any system to comply with the intent of this specification shall be accomplished at no additional cost to the Owner.

1.11 WARRANTY

A. This contractor shall warrant that the complete systems installed under this contract shall be free

of defects in workmanship and materials for a period of one (1) year from the date of substantial completion by the arch/owner.

B. If defects occur during the one year guarantee period, this contractor shall repair or replace such defects at no expense to the owner and to the satisfaction of the owner and engineer.

PART 2 PRODUCTS

2.01 GENERAL

A. Where the quality of required material is not specified, the Contractor shall furnish a first class standard item as approved by the Architect/Engineer.

B. Capacities of equipment and materials shall not be less than those indicated.

C. All work performed shall provide a neat and workmanlike appearance when completed, to the satisfaction of the engineer.

D. Provide 3-1/2” concrete base for all floor mounted equipment unless shown or noted otherwise. Provide 6x6 welded wire fabric reinforcing minimum or as required by the structural engineer.

E. Adequately protect equipment from damage after delivery to the jobsite. Cover with heavy polyethylene plastic. Elevate equipment when there is danger of water damage. Equipment damaged will be rejected.

F. Any scratches to factory finishes shall be touched up using factory supplied paint before final acceptance. If extensive damage to factory finishes has occurred, equipment panels shall be replaced to the satisfaction of the engineer. If rust has formed, remove as recommended by the manufacturer prior to touch-up.

2.02 EQUAL PRODUCTS OF LISTED MANUFACTURERS

A. In general, the specifications and drawings identify required materials and equipment by naming first the manufacturer whose product was used for the basis of design. The manufacturer’s product, series, model, catalog, and/or identification numbers shall set quality, construction and dimensional requirements for comparing the other manufacturer’s products. The capacity and performance of all equipment shall meet or exceed what is indicated by the Construction documents.

B. Where other manufacturer’s names are listed, they are considered approved for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers have been shown.

C. Where other than first named products are used, it shall be the responsibility of the contractor to determine prior to bid time that his proposed materials and equipment selections do not require adjustments in the mechanical or electrical connections as indicated by the Construction Documents. The contractor shall include in his bid all costs associated with any required adjustments.

PART 3 EXECUTION

3.01 INSTALLATION

A.

B. Install all equipment in strict accordance with the manufacturer's recommendations and the shop drawings reviewed by the Engineer.

C. The complete installation shall function as designed and intended with respect to efficiency, capacity, and noise level, etc. Any abnormal noise caused by rattling equipment or conduit will

not be acceptable

D. For locations of equipment, conduit, and other work, contractor shall coordinate exact locations subject to structural conditions, work of other contractors, access requirements, and the approval of the architect and engineer.

E. Any item interfering with proper placement of other work shall be removed and relocated without extra cost if reasonable coordination would have eliminated the interference. Damage to other work caused by this contractor shall be restored as specified for new work.

F. Written dimensions are preferred over scaled dimensions. When written dimensions are not available, the contractor shall be responsible for determining the proper installed location.

G. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification.

H. Contractor shall perform initial start-up of systems and shall provide necessary supervision and labor to make the first seasonal change-over of systems. Owner's operating personnel shall be present during this operation.

I. It is the contractor's responsibility to provide materials and trim which fit properly the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.

3.02 CONNECTIONS TO BUILDING STRUCTURE

A. Any item connecting to building structure shall be done in a manner accepted by the structural engineer.

B. When bar joists are used for steel construction, items shall be supported from angle iron spanning the top chord of the joists.

3.03 CLEANING

A. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.

3.04 EXISTING UTILITIES

A. Locate and mark all known utilities prior to proceeding with work. Proceed with caution since unmarked utilities may exist on site.

B. Should any existing utilities be damaged or disrupted, immediately notify Owner and repair to existing conditions.

C. The Contractor shall closely coordinate all utility downtime with the Owner and Architect giving a minimum fourteen (14) day notice prior to downtime.

D. Downtimes are to be held to a minimum duration with the Owner being notified as to the extent of said downtime.

End of Section 27 01 00

SECTION 27 20 13 – DATA/PHONE SYSTEM REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Division requires the furnishing and installing of complete functioning communications systems, and each element thereof, as specified or indicated on the Drawings, by the Specifications, or reasonably inferred; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include materials, labor, supervision, supplies, equipment, transportation and utilities.

B. Division 27 of the Specifications and Drawings numbered with prefix T generally describe these systems, but the scope of the Communications work includes all such work indicated in all of the Contract Documents: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing and Electrical Drawings and Specifications; and Addenda.

C. The Drawings convey the scope of work, indicating the intended general arrangement of the equipment, fixtures, outlets and conduit/cable without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. The Drawings shall be used as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will insure a complete, coordinated, satisfactory and properly operating system.

1.02 QUALITY ASSURANCE

A. All work under this division shall be executed in a thorough and professional manner by competent and experienced workmen duly trained to perform the Work specified.

B. All work shall be installed in strict conformance with all manufacturers' requirements and recommendations. All equipment and materials shall be installed in a neat and professional manner and shall be aligned, leveled, and adjusted for satisfactory operation.

C. All material and equipment shall be new, shall be of the best quality and design, shall be free from defects and imperfections and shall have markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. All material and equipment of the same type shall be made by the same manufacturer whenever practicable.

1.03 CODES, REFERENCES AND STANDARDS

A. Execute all Work in accordance with the latest edition and addendums of the National Electrical Code, the National Electrical Safety Code, and with all local, state, national codes, ordinances, and regulations in force governing the particular class of Work involved.

B. Any conflict between these Specifications and accompanying drawings and the applicable local, state and national codes, ordinances and regulations shall be reported to the Architect or Owner's Representative in sufficient time, prior to the opening of Bids, to prepare the Supplementary Drawings and Specification Addenda required to resolve the conflict. If the conflict is not reported timely, prior to the opening of bids, it shall be the responsibility of the Contractor to resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Architect or Owner's Representative, without additional compensation.

C. The governing codes are minimum requirements. Where these Drawings and Specifications exceed the code requirements, these Drawings and Specification shall prevail.

ADA	Americans with Disabilities Act
ANSI	American National Standards Institute
BOCA	Building Officials Code Administration
BICSI	Building Industry Consulting Services International
IEEE	Institute of Electrical & Electronic Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufactures' Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Hazard Act
TIA/EIA	Telecommunications Industry Association /Electronic Industries Association
UL	Underwriter's Laboratories

D. All material, manufacturing methods, handling, dimensions, method of installation and test procedure shall conform to the following industry standards and codes:

E. Contractor shall comply with rules and regulations of public utilities and municipal departments affected by connections of services.

F. All Communications work shall be performed in compliance with applicable safety regulations, including OSHA regulations. All safety lights, guards, and warning signs required for the performance of the communications work shall be provided by the Contractor.

G. All permits, licenses and fees that are required by the governing authorities for the performance of the communications work shall be obtained and paid for by the Contractor.

1.04 COORDINATION

A. For coordination of Electrical work, refer to Division 26 – ELECTRICAL SPECIFICATIONS

B. The Contractor shall visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provision for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any Work covered by this Division.

C. The Contractor shall refer to Drawings of the other Disciplines and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. The Contractor shall make all offsets required to clear equipment, beams and other structural members; and to facilitate concealing cable/conduit in the manner anticipated in the design.

D. The contractor shall provide materials with trim elements which will fit properly the types of ceiling, wall, or floor finishes actually installed, and to join separate elements of the same installed system.

E. The Contractor shall maintain a BICSI level II Installer on the jobsite at all times to coordinate his work with other contractors and subcontractors so that various components of the communications systems will be installed at the proper time, will fit the available space, will allow proper service access to all equipment, and will be installed in a thorough and professional manner. Carry on the Work in such a manner that the Work of the other contractors and trades will not be handicapped, hindered, or delayed at any time.

1.05 MEASUREMENTS AND LAYOUTS

A. The Drawings are schematic in nature, they show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the building. Figured dimensions shall be taken in preference to scaled dimensions. Determine

exact locations by job measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. The Contractor will be held responsible for errors which could have been avoided by proper checking and inspection.

1.06 GUARANTEES AND WARRANTIES

A. Each system and each element thereof shall be warranted against any defect due to faulty workmanship, design or material for a minimum period of 12 months from date of Project Completion, unless specific items are noted to carry a longer warranty in the Construction Documents or manufacturer's standard warranty. The Contractor shall remedy any defect occurring within a period of one year from the date of Project Completion or as stated in the General Conditions.

B. The above guarantees shall include both labor and material; and repairs or replacements shall be made without any additional cost to the Owner.

C. The remedial work shall be performed promptly, upon written notice from the Architect or Owner.

D. At the time of Project Completion, deliver to the Owner all warranties with terms extending beyond the one year guarantee period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

PART 2 PRODUCTS AND MATERIALS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification are as below and shall represent the minimum level of construction. Equipment manufactured by STI, Hilti and 3M shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 SUBMITTALS

A. Assemble and submit for review, Shop Drawings consisting of manufacturers product literature and performance sheets for all material and equipment to be furnished and/or installed under this Division. Submit number of copies as required by the General Conditions but not less than five (5) copies.

B. Shop Drawings shall be submitted for all communications equipment, materials, and devices such as distribution equipment, wiring devices, and special systems in sufficient detail so as to demonstrate compliance with the Contract Documents and design concept.

C. Refer to individual Sections for additional submittal requirements.

D. Submit Shop Drawings as early as required to support the project schedule. Allow for two weeks Engineer review time plus mailing time plus a duplication of this time for resubmittal if required. Submittal of all Shop Drawings as soon as possible before construction starts is preferred.

E. Before submitting Shop Drawings and material lists, the Contractor shall verify that all equipment submitted is mutually compatible and suitable for the intended use. He shall verify that all equipment will fit the available space, comply with clearance requirements, and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

F. A transmittal letter shall accompany each shop drawing or samples indicating the project name, project number, and listing individually each item being submitted for approval. If the submittal

is for a specific specification section, drawing, sheet or detail, the transmittal shall refer to each. Submittals not so identified will be returned to the contractor without action.

G. The Architect's and/or Engineer's checking and subsequent acceptance of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect or Engineer's attention to such deviations at the time of submission, and secured his written acceptance; nor shall it relieve him from responsibility for errors in dimensions, details, size of members, or quantities; or omissions of components or fittings; or for coordinating items with actual building conditions and adjacent work.

PART 3 EXECUTION

3.01 PERMITS

A. Secure and pay for all permits required in connection with the installation of the Communications Work. Arrange with the various utility companies for the installation and connection of all required utilities for this facility and pay all charges associated therewith including connection charges and inspection fees, except where these services or fees are designated to be provided by others.

3.02 EXISTING CONDITIONS

A. Existing conditions indicated by the Construction Documents are taken from the best information available from the existing drawings and from visual site inspection, and are not to be construed as "AS BUILT" conditions. The information is shown to help establish the extent of the new work to be done.

B. The Contractor shall be responsible for verifying all actual existing conditions at the project site and perform the work as required to meet the existing conditions and the intent of the work indicated.

3.03 ACCESS TO EQUIPMENT

A. All pull boxes, junction boxes or controls shall be identified and shall be located so as to provide easy access for operation, service inspection and maintenance. Provide an access door where equipment or devices are located above inaccessible ceilings.

B. Maintain all code required clearances and clearances required by manufacturer.

C. The cutting of new and/or existing construction shall not be permitted except by written approval of the Architect or Owner.

3.04 PENETRATIONS

A. Unless otherwise noted as being provided under the general construction work or the Electrical Construction, the Communications Contractor shall include the furnishing and installing of sleeves and/or box frames to provide openings in floors, walls, partitions and ceilings for all Communications work. Where communication cables and pathways penetrate building construction, EZ-Path brand fire-stop products are recommended for use in up to (4) hour rated construction.

B. Provide sleeves and/or box frames for all conduit, cable, busway, etc. that passes through masonry, concrete or block walls.

C. The cutting of new and/or existing construction shall not be permitted except by written approval of the Architect or Owner's Representative.

3.05 ADJUSTING, ALIGNING AND TESTING

A. Adjust, align and test all equipment furnished and/or installed under this Division.

B. Protective devices shall be checked and tested for specified and required application and adjusted as required.

C. Completed communications systems shall pass specified tests and performance criteria.

D. This Contractor shall be held responsible for the operation, service and maintenance of all new Communications equipment during construction and prior to acceptance by the Owner of the complete project under this Contract. All Communications equipment shall be maintained in the best operating condition.

E. Notify the Architect/Engineer immediately of any operational failure caused by defective material and/or labor.

F. Maintain service and equipment for the testing of communications equipment and systems until all work is approved and accepted by the Owner.

G. A Level III cable tester shall be kept available at all times during the testing and review phase of cabling projects, and the Contractor shall provide service for test readings when and as required.

3.06 START-UP OF SYSTEMS

A. Prior to start-up of communications systems, Communications Contractor shall check all components and devices and tighten all terminations, cross-connects, panels, and outlets after NTS has completed final cross connects between network and voice termination field and horizontal termination field.

B. Each communications circuit shall be energized, tested and proved free of breaks, short-circuits or grounds or mis-wiring.

C. After all systems have been inspected and adjusted, confirm that all programming, operating features, and functions required by the Drawings and Specifications are operational and make final adjustments and reprogramming as necessary.

D. All equipment and systems shall be demonstrated to perform properly as designed per plans and specifications.

E. At the time of final review and tests of the communications systems, all equipment, system components, programming, and features shall be in place and all connections shall be complete. All hardware shall be in place, and all circuits shall be continuous from point of service connections to all switches, outlets, terminations, etc.

3.07 TEST REPORTS

A. The Contractor shall perform tests as required by this Specification and submit the results in the maintenance manuals. The tests shall establish the adequacy, quality, safety, and reliability for each system installed. Notify the Architect/Engineer two working days prior to each test. Final tests are to be submitted to NTS in electronic format for approval prior to project close-out.

B. For specific testing requirements, refer to the Specification section that describes that system.

C. Upon completing each test, record the results, date and time of each test and the conditions under which the test was conducted. Submit to the Engineer in duplicate the test required in each Section of this Specification.

D. The contractor shall promptly correct any failure or deficiency revealed by these tests as determined by the Architect/Engineer.

End of Section 27 20 13

SECTION 27 20 15 – DATA/PHONE SYSTEM STRUCTURED CABLING

PART 1 GENERAL REQUIREMENTS

1.01 SECTION INCLUDES:

A. Telecommunications Room 5A

B. Backbone Cabling Subsystem

C. Horizontal Cabling Subsystem

D. Work Area Subsystem

1.02 DESCRIPTION OF WORK

A. The extent of work for this communications cabling system includes providing backboards, frames, cabinets, patch panels, punch blocks, cable, fiber, terminations, faceplates, outlets, documentation, and testing for a fully functioning and certified cabling system.

B. All cabling is to be suspended above drop ceiling with J-hooks where applicable. All runs must be kept straight with a neat appearance, no diagonal runs. Zip ties will not be allowed. All cables will be attached and bundled using Velcro straps.

C. Metal conduit will be used for all surface mount locations. If drywall is available the runs will be flush mounted inside the walls.

1.03 CERTIFICATIONS AND REQUIRED DELIVERABLE ITEMS

A. Telecommunications Contractor Qualifications: The Design Team shall evaluate the Telecommunications Contractor (TC) to insure that the TC is fully capable and experienced in the telecommunication system specified before bid opening. The following qualifications shall be used by the Design Team in this evaluation:

1. The TC must have a RCDD on staff to inspect the installation and to put into writing they certify that the installation meets all TIA, NEC standards and codes and that the installation was done per the specifications and drawings.
2. The TC provides a minimum of five (5) references for which the contractor has completed similar work (number of drops and cost) within the last five years.
3. The TC must be AVAYA Certified, or Siemons Certified, or Leviton certified, or Ortronics .
4. Certified, or Belden/CDT Certified System Vendor or a Belden/CDT Installation Qualified Contractor.
5. The TC will certify in writing that the lead technician on the job site shall be BICSI Installer Level II certified and a minimum of 5 years experience installing telecommunications structured cabling systems.

B. Telecommunication Contractor's Obligations: The contractor shall furnish and install all material required for a complete system, including the installation and termination of communication cables, communication outlets, and the termination of all cables in the Service Entrance and Termination Room, Equipment Room, and Telecommunications Room.

1. The contractor shall test and certify all cable installed by the contractor and provide documented results of the testing. The documented results of the testing shall be supplied to NTS in electronic format for approval prior to project close-out.
2. All category 5E cable shall be certified to 100 MHz.
3. The contractor shall replace at no charge to the Owner; any cable that tests defective, is not installed in a neat and workmanlike manner, is kinked, exceeds bend radius, has stretched jackets or has been secured with tie-wraps that have been over-tightened.

4. The contractor shall correct at no charge to the Owner; any cable that has more then 1" of jacket removed at the termination points. If the cable cannot be re-terminated without eliminated the proper slack, the contractor will replace the cable at no charge to the Owner.
5. A one-year materials and labor warranty shall be provided on all cable and hardware installed by the telecommunications contractor.

C. Quality Assurance

1. All work under this provision shall be performed in a thorough and professional manner by a competent workforce. All telecommunications equipment and materials shall meet the requirements called for in the governing standards. All means and methods not otherwise described or indicated in the Contract Documents shall be under control and approval of the Owner's Representative.
2. Surplus materials, waste and construction debris which is not part of the built environment shall be removed from the project site and disposed of in a legal and safe manner.

1.04 SUBMITTALS

A. Submit Shop Drawings as required by Division 1.

1. Cable rack elevations indicating layout off all components including Owner provided equipment
2. Telecommunications room layouts indicating locations of all components including Owner provided equipment

B. Submit documentation and references with bid in support of Sec. 1.03 Quality Assurance.

C. Submit product data with bid for any manufacturer's items not specified in this document, including:

1. Cable and fiber
2. Patch panels and punch blocks
3. Faceplates, work area outlets, and terminations
4. Cabinets, racks, and frames
5. Cable support devices and tray
6. Submittals for electrical boxes and raceway shall be required under this section unless included with submittals under DIVISION 16 - BASIC MATERIALS AND METHODS.

1.05 REGULATORY REQUIREMENTS

A. Provide products listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose intended.

1.06 MAINTENANCE MANUALS AND RECORD DRAWINGS

A. The contractor will provide As-Built documents in both hard and soft copy form upon completion of project. Hard copy and Soft copy documents will consist of individual files, by building, with cable count, cable pairs, strand count, jack number and locations, GPS coordinates of all hand holes, product specification documents and warranty information of all products installed. All new cabling will be labeled with a permanent label on the cable at both ends as well as the faceplate of the jack according to Section 4. LABELING in the NGMO Standard Operating Procedures document (see attached). All OSP cables will be tagged/labeled with a waterproof tag using permanent indelible ink (can be affixed with zip ties) in each HH they pass thru with the building it is coming from and the building it is going to along with the strand/pair count of that particular cable.

B. Submit Record Drawings as required by Division 1.

1. Accurately record installation information including cable location, label, cable type, configuration, date of installation/termination, test results, installer/tester, and project manager's approval. Provide in written and electronic format (Microtest PENTA format).
2. Provide printed and bound test results for all cables. The documented results of the testing shall be supplied to NTS in electronic format for approval prior to project close-out.
3. Accurately record actual location and routing of all patch panels, raceway, conduit, cabling, and terminations used for the communications cabling system.

PART 2 PRODUCTS AND MATERAIALS

2.01 VOICE DROPS

A. Voice drops are to be white CAT6 cable with white Hubbell Xcelerator CAT6 Keystone jacks part #HXJ6W and Data drops are to be blue CAT6 cable with blue Hubbell Xcelerator CAT6 Keystone jacks part #HWJ6B. Face plates will be white plastic Hubbell part #IFP1"2"W. Patch panels will be Hubbell part #UDX24E (unloaded) and will be supplied by contractor.

B. All pulls will terminate in the telecommunications room.

C. All WAP runs will have a label affixed to the ceiling tile grid work where the drop is located.

D. All new white drops will be terminated onto 24 port unloaded patch panels. All new blue drops will be terminated onto a separate 24 port unloaded patch panels.

2.02 TELECOMMUNICATIONS ROOMS

A. General

1. The Satellite Telecommunications Rooms consists of all cabinets, racks, backboards, patch panels, punch blocks, fiber optic panels, cable tray, support hardware, cable management hardware, patch cords, cross connects, terminations, and labeling for use in rooms designated as central termination locations and distribution points for backbone and/or horizontal cabling for a facility.
2. Contractor will supply a 6U vertical lockable cabinet Black Box RMT353A-R2 or similar.

B. Installation Requirements

1. New conduits and sleeves shall extend 2" above floor level and through walls
2. Install cable tray in the main telecommunications room as indicated.
3. Provide cable tray "down spouts" to each rack, or cabinet to allow for vertical transitions.

C. Telecommunications Backboard

1. 3/4" X 4' X 4' type A/C fire retardant plywood, with the "A" side facing the telecom room, with the bottom edge at 6" aff, to cover telecommunication room walls dedicated to telecommunications equipment installation, painted ivory with fire retardant paint, placed with the 8' edge vertical, fastened securely with a minimum of five (5) equally spaced fasteners along each vertical edge and one column of five (5) equally spaced fasteners centered on each sheet of plywood.

D. Cable Termination – Horizontal – Category 5e

1. Copper horizontal cabling terminated in Telecommunication Rooms will terminate on Nordx GigaBIX Connectors.
2. 6 – Port capacity, per GigaBIX Connector

3. Twelve 6-Port Connectors per GigaBIX Mount
4. GigaBIX Mount for wall installation
5. BIX/BIX Termination with GigaBIX Wire Guard (#AX101486)
6. Category 5e

E. Cable Termination – Fiber Optic

1. All fiber optic cabling shall terminate on rack-mounted Closet Connector Housing.
2. The multimode and single mode fibers shall be terminated in different Closet Connector Housing units.

F. Fiber Optic Termination – Connector Type

1. Provide termination of all fiber optic strands with a keyed ceramic fiber-optic connector plug.
2. Shall have a bayonet-type "ramp-latching" mounting arrangement
3. Shall have a zirconium ferrule
4. Shall be field terminated, using an epoxy-based method, as approved by manufacturer.

G. Cable Management – Structured Cable Systems

1. Provide cable management and labeling devices for organization and distribution of cabling.

H. Cross Connect – Patch Cords – Multi-mode Fiber

1. Multimode (62.5 micron)
2. Duplex cordage
3. STII – STII connectors
4. Provide two (2) duplex fiber patch cords for each pair of terminated multi-mode fiber

I. Distribution Support – Vertical Cable management

1. 2" x 4" x 7' Vertical Cable finger duct
2. Color: Black
3. For wall mount rack, cut to length in field

J. Distribution Support – Horizontal Cable Management

1. Horizontal Distribution Rings as required by installation

K. Cross Connect – Patch Cords

1. Cords must meet or exceed the electrical specifications and performance requirements of the overall cable system (channel performance testing).
2. Length shall be from the horizontal field GigaBix Mount to the bottom of the open frame rack, inclusive of all changes in direction
3. Terminated T568A/B to Open
4. These parts are custom manufactured by Nordx/CDT; they are not regular stock items.

2.03 BACKBONE / RISER CABLING

A. General

1. The Backbone Subsystem consists of all fiber optic and copper cabling UTP used for interconnection between the main and satellite telecommunications room. The Backbone Subsystem includes indoor rated cables for building distribution systems.

B. Fiber Optic Cable – Multimode Backbone – Plenum Rated

1. All fiber optic cabling shall be NEC rated: OFNP, 62.5/125 multimode, tight buffered graded index (12) strand fiber optic cable of all glass construction. This cable shall be

used to inter-connect the new telecommunication rooms.

C. Fiber Optic Cable – Single-mode Backbone – Plenum Rated

1. All fiber optic cabling shall be NEC rated: OFNP, single-mode, tight buffered graded index (12) strand fiber optic cable of all glass construction. This cable shall be used to inter-connect the new telecommunication rooms.
2. Twelve (12) strand fiber optic cable

D. Fiber Optic Support and Protection – Inner duct – Plenum Rated

1. Inner duct shall provide support and physical protection for fiber optic cable, which is not installed within conduit dedicated to fiber optic use. It shall be rated for plenum use.
2. Inner duct shall be sized by contractor.
3. Shall be UL listed for use in plenum spaces.
4. Shall be equipped with a pull tape rated to 200lbs
5. Shall be orange in color.

E. UTP Cable – Category 3 Riser

1. All cabling will be multi-pair, Unshielded Twisted Pair (UTP) cable that meets or exceeds the following specifications:
   a. 100 Ohm / 10 MHz
   b. 4 pair to 200 pair
   c. Category 3 cable
   d. 24 AWG solid copper conductors
   e. NEC Rated: CMP

2.04 HORIZONTAL CABLING - GENERAL

A. The Horizontal Cabling Subsystem consists of copper cabling (UTP) used for interconnection between the telecommunication rooms and the work area subsystem.

B. UTP Cable – Category 5e – Plenum Rated

1. All cabling will be 4-pair, 8-wire Unshielded Twisted Pair (UTP) cable that meet or exceed the following specifications:
   a. 24 AWG solid copper conductors.
   b. NEC rated: CMP
2. Color shall be: Yellow.

PART 3 EXECUTION

3.01 GENERAL

A. Unless otherwise stated, where installation requirements identified in drawings and specifications conflict with the manufacturer's recommendations, the more restrictive standard shall apply

B. Bring to the attention of the Owner and Engineer conflicts between manufacturer's instructions and Construction Documents

3.02 CABLING SYSTEM

A. The Drawings indicate the general location of the provisions for the cabling required for the building. Coordinate actual requirements with the Owner and Engineer.

B. All cable shall be run parallel and perpendicular to structure. Diagonal or shortest path runs will not be accepted unless specified or shown on drawings.

C. All cabling is to be suspended above drop ceiling with J-hooks where applicable. All runs must be kept straight with a neat appearance, no diagonal runs. Zip ties will not be allowed. All cables

will be attached and bundled using Velcro straps.

D. Metal conduit will be used for all surface mount locations. If drywall is available the runs will be flush mounted inside the walls.

E. Voice, data, and video, UTP, and/or fiber optic cables running parallel horizontally or vertically in any cabling subsystem shall be aggregated by type into a single uniform bundle for each. Multiple parallel runs of cable will not be accepted unless indicated in the Drawings or these Specifications.

F. Install cabling using reusable Velcro cable management straps as needed for horizontal cable routing and patch cords in and around entrance facilities, main distribution frame, building distribution frame, and work area terminations.

G. Leave a pull cord with a minimum 200lb pulling tension in all conduit and raceway used.

H. Where not installed in conduit, cable tray, or raceway, cable shall be supported using approved wide base J-hooks and clamps mounted to structure. Bridle rings, cable ties or other narrow-gauge devices are not approved.

I. Mount cable supports between 36” and 48” on center or closer if needed to maintain cable support.

J. Cables shall be supported by approved devices along their entire length. Do not use mechanical, electrical, plumbing systems, ceiling tiles, or ceiling support wires for cable support.

K. Maintain bend radii appropriate for the performance standard and type of cable. Cables shall not be installed or routed in any manner that violates the manufacturer’s specifications. Minimum bend radius for cables during installation is 20 times the cable diameter. Minimum bend radius for cables following installation is 10 times the cable diameter.

L. Maintain continuous jacket integrity on all cabling up to the jack or termination contacts.

M. Maintain cable twists to termination contacts to ½” of or less.

N. Leave a minimum of 18” of spare wire at all connection points. The 18” of slack shall be coiled in a figure 8 configuration and restrained at the top of the conduit serving that connection.

O. Leave sufficient amount of slack in the horizontal cables so that they may reach the farthest point of the telecommunication room, plus enough cable to reach the floor from the horizontal cable management.

P. Leave sufficient amount of slack in the backbone cables so that the cables will reach the floor or ceiling, plus the distance across the backboard.

Q. Install all cabling according to BICSI cabling standards and practices.

3.03 TESTING

A. New cable runs are to be certified and test results are to be provided to the DOIM/ J6 POC.

B. All cables installed, relocated, or re-terminated as part of the Work shall be tested per these specification.

C. All cables shall be channel tested and include all cross-connections and passive cabling devices included in the Communications Cabling System. The Telecommunications Contractor shall perform the link test. Channel test will be performed by this contractor on final service provisioning of the outlets.

D. The following tests shall be performed by the Contractor for each Unshielded Twisted Pair cable.:

1. Continuity
2. Length

3. Attenuation
4. Wiremap
5. Near End Crosstalk (NEXT)
6. Characteristic Impedance
7. Return Loss
8. Equal Level Far End Crosstalk (ELFEXT)
9. Propagation Delay
10. Delay Skew
11. Pass/Fail for cable performance level, manufacturer and product.

E. The following tests shall be performed by the Contractor for each fiber optic cable:

1. Attenuation @ 850nm and 1300nm for multimode fiber
2. Attenuation @ 1310nm and 1550nm for singlemode fiber
3. OTDR traces shall be provided for all backbone fiber runs greater than 1000' in length or specified, and all outside plant fiber.
4. Acceptable loss readings for fiber optic cable are as follows:
   a. Multi mode
      - 3.5 dB per Km at 850 nm
      - 1.0 dB per Km at 1300 nm
      - .375 dB per connector
      - .3 dB per splice
   b. Single mode
      - .4 dB per Km at 1310 nm
      - .3 dB per Km at 1550 nm
      - .375 dB per connector
      - .3 dB per splice

F. The following test shall be performed by the Contractor for each coaxial cable run:

1. DC Loop resistance
2. Attenuation
3. Length

G. Test results shall be printed, bound and divided alphanumerically and by location. Test result shall be submitted to the Engineer for review prior to application for Project Completion.

H. Test results shall be also provided to Owner in paper summary, and on floppy or compact disc. Test results shall be reported in the Microtest Penta format.

End of Section 27 20 15

SECTION 28 01 00 – GENERAL SAFETY AND SECURITY REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, General Requirements (Division 1), and Section 23 05 13 - ELECTRICAL PROVISIONS OF HVAC WORK, Section 22 05 13 – ELECTRICAL PROVISIONS OF PLUMBING, and Section 21 05 13 – ELECTRICAL PROVISIONS OF FIRE PROTECTION apply to the work specified in Division 26 - ELECTRICAL.

B. Refer to section 26 – Electrical specifications for expectations of communications related equipment and installation not provided in following communications specifications.

1.02 DESCRIPTION OF WORK

A. The Electrical Contract includes all labor, material, and equipment required for the complete electrical systems as shown and specified.

1.03 QUALITY ASSURANCE

A. Each major component of equipment shall have the manufacturer's name, address, model number, rating, and UL label securely affixed in a conspicuous place.

B. All equipment of one type shall be the product of one manufacturer, unless specified otherwise.

C. In the event of discrepancies between the drawings and specifications, the contractor shall advise the engineer before proceeding with the work in order that correct progress is ensued.

D. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel." Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 SHOP DRAWINGS AND SUBMITTALS

A. Shop drawings shall be submitted as specified in Division 1. Product data shall be submitted for all materials and equipment specified in DIVISION 28. Shop drawings and submittals must be submitted in PDF format and emailed to the design team.

B. Shop drawings for equipment ‘Packages” shall be complete and include all items to be provided by a manufacturer’s representative or supply house. No partial submittals will be reviewed or approved without a complete and total equipment submittal.

C. Each shop drawing shall include a letter indicating all deviations from the drawings and/or specifications.

D. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:

1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
2. Capacity, pressure drop, rpm, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
3. Dimensional drawings showing layout, connection points, and detailed layout of components.
4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.
5. Conspicuously mark on each submittal the exact model, fittings, accessories, and devices to be supplied. When a schedule is shown on the drawings or in the specifications,

provide a copy of that schedule with the submittal.

6. Tags for equipment submitted shall match the tags indicated on the design drawings or specifications. Where equipment is noted on the drawings and not scheduled, refer to plan note and sheet number on the submittal.

E. Contractor shall check all shop drawings to verify that they meet the requirements of the drawings and specifications before forwarding to the architect and engineer. All shop drawings submitted shall bear the stamp of the contractor to show that they have been reviewed in detail.

F. No work shall be fabricated and no equipment ordered until the architect and engineer have returned acceptable reviewed shop drawings.

G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this section.

1.05 PROJECT SEQUENCING

A. The contractor shall refer to the architectural plans and specifications for areas of work and general schedules to determine the scope of work required during each phase of the construction.

B. All temporary equipment, etc. not indicated, but required by phasing, shall be included in the base bid.

1.06 SUBSTITUTIONS

A. The materials, products, and equipment described in these specifications or on the drawings establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. Listing of these manufacturers shall in no way be construed as a device intended to limit the bidders to those specifically listed.

B. Reference to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number, shall be interpreted as having established a standard of quality and shall not be construed as limiting competition. Articles, fixtures, etc. of equal quality by manufacturers listed in this specification for the applicable use, shall be acceptable, subject to spatial, structural, and electrical constraints of the project design.

C. The Engineer reserves last opinion as to a product's equality or superiority to that specified.

1.07 DEFINITIONS

A. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

B. Install: The term "install" is used to describe operations at the project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

C. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

D. Furnished by Owner or Furnished by Others: The item will be furnished by the Owner or Others. It is to be installed and connected under the requirements of this Division, complete and ready for operation, including all items incidental to the Work, including all services necessary for proper installation and operation. The Installation shall be included under the guarantee required by this Division.

E. The design engineer, referred to as "engineer" shall mean the engineering firm, HOSS & BROWN ENGINEERS, INC., Contact person: Brandon Frey

1.08 OPERATION AND MAINTENANCE MANUALS

A. Three (3) Flash Drives containing PDFs of Operation and Maintenance (O&M) Manuals shall be

submitted as described below. Files and folder names shall be clearly labeled. Folder structure and names shall be intuitive and clearly labeled.

B. Before project close-out, submit O&M operating, maintenance instructions, and parts lists for equipment provided. Include in the manual a list of emergency service organizations capable of rendering service for each piece of equipment.

C. Keep in a safe place all keys, wrenches, and other specialty tools furnished with equipment. Present to owner at project close-out and receive a receipt showing he has received the same.

D. At the completion of the project furnish to the Architect for the Owner O&M brochures divided and tabbed, containing all data, diagrams, capacities, spare part numbers, manufacturers service and maintenance data, warranties, guarantees, etc., including local contacts and escalation schedule complete with addresses and telephone numbers, of all equipment, apparatus, and system components furnished and installed under this Division of the specifications.

1.09 CODES AND ORDINANCES

A. All work shall be in accordance with applicable codes, rules, ordinances, and regulations of local, state, and federal governments and other authorities having jurisdiction.

B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard, to any ordinances, laws, codes, rules, or regulations bearing on work, the contractor shall execute work in accordance with such without increased cost to the owner, but not until he has referred such variances to the engineer.

C. The contractors shall secure and pay for the necessary permits and certificates of inspection for their trade. Keep record of all permits and inspections and submit two copies to the engineer with request for final inspection.

1.10 OWNER TRAINING

A. Contractor shall demonstrate to the owner that all mechanical systems installed under this division of the specifications are complete and operating as intended. Contractor shall provide documentation to owner of owner training.

B. Any adjustments or other additional work required as a result of failure of any system to comply with the intent of this specification shall be accomplished at no additional cost to the Owner.

1.11 WARRANTY

A. This contractor shall warrant that the complete systems installed under this contract shall be free of defects in workmanship and materials for a period of one (1) year from the date of substantial completion by the arch/owner.

B. If defects occur during the one year guarantee period, this contractor shall repair or replace such defects at no expense to the owner and to the satisfaction of the owner and engineer.

PART 2 PRODUCTS

2.01 GENERAL

A. Where the quality of required material is not specified, the Contractor shall furnish a first class standard item as approved by the Architect/Engineer.

B. Capacities of equipment and materials shall not be less than those indicated.

C. All work performed shall provide a neat and workmanlike appearance when completed, to the satisfaction of the engineer.

D. Provide 3-1/2” concrete base for all floor mounted equipment unless shown or noted otherwise. Provide 6x6 welded wire fabric reinforcing minimum or as required by the structural engineer.

E. Adequately protect equipment from damage after delivery to the jobsite. Cover with heavy polyethylene plastic. Elevate equipment when there is danger of water damage. Equipment damaged will be rejected.

F. Any scratches to factory finishes shall be touched up using factory supplied paint before final acceptance. If extensive damage to factory finishes has occurred, equipment panels shall be replaced to the satisfaction of the engineer. If rust has formed, remove as recommended by the manufacturer prior to touch-up.

2.02 EQUAL PRODUCTS OF LISTED MANUFACTURERS

A. In general, the specifications and drawings identify required materials and equipment by naming first the manufacturer whose product was used for the basis of design. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality, construction and dimensional requirements for comparing the other manufacturer's products. The capacity and performance of all equipment shall meet or exceed what is indicated on the drawings and/or scheduled.

B. Where other manufacturer's names are listed, they are considered approved for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers have been shown.

C. Where other than first named products are used, it shall be the responsibility of the contractor to determine prior to bid time that his proposed materials and equipment selections do not require adjustments in the mechanical or electrical connections as shown on the drawings. The contractor shall include in his bid all costs associated with any required adjustments.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all equipment in strict accordance with the manufacturer's recommendations and the shop drawings reviewed by the Engineer.

B. The complete installation shall function as designed and intended with respect to efficiency, capacity, and noise level, etc. Any abnormal noise caused by rattling equipment or conduits will not be acceptable

C. Locations of equipment, conduit, and other work are indicated diagrammatically on the drawings. Each contractor shall coordinate exact locations subject to structural conditions, work of other contractors, access requirements, and the approval of the architect and engineer.

D. Any item interfering with proper placement of other work shall be removed and relocated without extra cost if reasonable coordination would have eliminated the interference. Damage to other work caused by this contractor shall be restored as specified for new work.

E. Written dimensions are preferred over scaled dimensions. When written dimensions are not available, the contractor shall be responsible for determining the proper installed location.

F. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification.

G. Contractor shall perform initial start-up of systems and shall provide necessary supervision and labor to make the first seasonal change-over of systems. Owner's operating personnel shall be present during this operation.

H. It is the contractor's responsibility to provide materials and trim which fit properly the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on

drawings are not intended to designate the required trim.

3.02 CONNECTIONS TO BUILDING STRUCTURE

A. Any item connecting to building structure shall be done in a manner accepted by the structural engineer.

B. When bar joists are used for steel construction, items shall be supported from angle iron spanning the top chord of the joists.

3.03 CLEANING

A. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.

3.04 EXISTING UTILITIES

A. Locate and mark all known utilities prior to proceeding with work. Proceed with caution since unmarked utilities may exist on site.

B. Should any existing utilities be damaged or disrupted, immediately notify Owner and repair to existing conditions.

C. The Contractor shall closely coordinate all utility downtime with the Owner and Architect giving a minimum fourteen (14) day notice prior to downtime.

D. Downtimes are to be held to a minimum duration with the Owner being notified as to the extent of said downtime.

End of Section 28 01 00

SECTION 28 05 15 – FIRE ALARM CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the control and data cables as specified and the cable routing indicated on the plans.

1.02 LOCATION OF CABLES

A. All cables located in environmental air plenum will be plenum rated cables.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The basis for this specification is West Penn and shall represent the minimum level of construction. Material manufactured by Belden, Allied Wire & Cable, and Anixter, shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 FIRE ALARM WIRING

A. Fire alarm wiring shall be solid, unstranded power limited cable as follows:

1. Non-Plenum Mapnet: West Penn D975, or approved equal, 1PR, 18GA shielded or approved equal
2. Plenum Network and Mapnet: West Penn 60975, or approved equal, 1PR, 18GA shielded or approved equal
3. 16GA Non-Plenum: West Penn 991, or approved equal, 1PR unshielded or approved equal
4. 16GA Plenum: West Penn 60990B, or approved equal, 1PR shielded or approved equal
5. 14GA Non-Plenum: West Penn 994, or approved equal, 1PR shielded or approved equal
6. 14GA Plenum: West Penn 60993B, or approved equal, 1PR unshielded or approved equal

PART 3 EXECUTION

3.01 GENERAL

A. The circuiting of all devices has been shown on the plans, and this Contractor shall follow this circuiting layout.

B. Fire alarm wiring for this system shall be Fire Alarm plenum rated cable, or run in EMT, or ridged conduit. All wiring in walls shall be in conduit with rough-in boxes.

3.02 WIRING

A. All wiring shall be installed in strict compliance with all the provisions of National Electrical Code, Article 760 A and C, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with National Electrical Code, Article 760 A and B. All required wiring shall have a minimum insulation rating of 600 volts.

B. All cabling shall be installed in strict compliance with all the provisions of NEC Article 760, Power-Limited Protective Signaling Circuits. Cabling shall have a minimum insulation rating of 300 volts.

C. The contractor shall provide all control equipment with a minimum of a “Dedicated, Insulated

GREEN #12" ground wire. Conduit grounding will not be accepted. It shall be properly connected to the building unified ground buss.

End of Section 28 05 15

SECTION 28 31 01 – FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 Scope and Related Documents

A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the installation of the Sprinkler Occupancy Notification System, hereinafter referred to as the Fire Alarm System, as shown on the drawings and as herein specified.

B. The requirements of the conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.

C. The complete installation is to conform to the applicable sections of NFPA-72, Local Code Requirements and National Electrical Code with particular attention to Article 760 and all other applicable regulatory requirements.

D. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.

1.02 Regulatory Requirements

A. The system and all associated operations shall be installed in accordance with all applicable codes.

B. Equipment: All devices, combinations of devices, notification appliances, and equipment, shall be listed for the purpose for which they are used and shall be installed in compliance with applicable codes and standards.

1.03 System Description

A. Fire Alarm System: Provide a complete, supervised, power-limited, fire detection and evacuation system.

1. All equipment herein referenced is that of SimplexGrinnell and depicts the type and quality of the equipment to be furnished. Refer to Submittals, Products/Manufacturers, and Products/Substitutions sections in this specification for further information and qualifications.

B. System Supervision: The fire alarm system shall be an electrically supervised system which shall monitor the integrity of circuit conductors and power supplies. Performance of fire alarm system circuits shall be in accordance with Class B(Style B) operation for Initiating Device Circuits, and Class B (Style Y) operation for Notification Appliance Circuits. Remote annunciator LEDs and associated wiring and remote emergency control wiring shall be supervised such that an open condition in the circuit shall cause a trouble indication at the control panel.

C. Alarm Sequence of Operation. Activation of an alarm Initiating Device shall:

1. Cause the display of the number of the zone in alarm. In the event that multiple zones are in alarm, the zone numbers shall be scrolled in chronological order.
2. Activate the panel tone-alert audible indicator.
3. Cause the audible alarm Notification Appliances to sound.
4. Cause the common Auxiliary Alarm output to activate.
5. Cause the IDC Auxiliary output to activate.
6. Cause the Visual Notification Appliances to operate.

7. Cause an alarm signal to be transmitted to the Remote Supervising Station.
8. Cause the remote tone-alert audible signal and associated red zone LED on the remote annunciator to flash, if remote annunciator is shown on plans.
9. Cause a signal to be sent to the building elevator controls, if applicable.
10. Release all door hold-open devices, if applicable.

D. Alarm Acknowledge:

1. Activating the Acknowledge switch shall cause the local panel audible tone-alert to silence.
2. Subsequent alarms shall resound the local panel tone-alert.
3. Activating the Alarm Silence switch shall silence all NACs programmed for on-until-silence and shall illuminate the dedicated yellow alarm silenced LED.

E. Alarm Reset: Restoring the alarm initiating devices to normal and activating the System Reset switch shall restore all alarm circuits to their normal condition.

1.04 Qualifications

A. Manufacturer: The Manufacturer shall be a nationally recognized company specializing in detection and alarm systems. This organization shall employ factory trained and NICET certified technicians, and shall maintain a service organization within 100 miles of this project location. The Manufacturer and service organization shall have a minimum of 10 years experience in the fire detection and alarm systems industry.

B. Installer: The installation organization shall be a company specializing in the installation of detection and alarm systems. This organization shall have a minimum of 10 years experience with installation of fire detection and alarm systems. The fire alarm system shall be installed by NICET certified or factory trained installers.

PART 2 PRODUCTS

2.01 Approved Manufacturers

A. The basis for the conduit specification is SimplexGrinnell and shall represent the minimum level of construction. Systems manufactured by Edwards Systems Technology and Notifier shall be permitted to bid these specifications.

B. Products listed below shall be the basis of design. Products provided by manufacturers listed in the approved manufacturers section above shall be allowed to provide products equivalent to those listed as basis of design.

2.02 Fire Detection and Control Panel

A. Where shown on the plans, provide and install a Simplex type 4006 Fire Alarm Control Panel or approved equal. Construction shall be modular with solid state, microprocessor based electronics.

B. The Fire Alarm Control Panel shall contain:

1. Operator interface switches for status acknowledge, alarm silence, and system reset.
2. Discrete LED indicators to annunciate the following: presence of AC power, status of alarm silenced feature, presence of supervisory conditions.
3. A red, seven segment LED display shall be provided to annunciate the following:
   a. The zone number of an IDC in Alarm
   b. Multiple IDCs in Alarm shall be annunciated by scrolling the number of the zones in chronological order. Scrolling shall be automatic with manual

intervention as required to hold and scroll.

c. The number of an IDC in a supervisory condition with the decimal point of the display illuminated as a supervisory indicator. This shall be accompanied by the illumination of the supervisory LED.

d. Multiple IDCs in supervisory shall be annunciated by scrolling the number of the zones in chronological order.

4. A yellow, seven segment LED display shall be provided to distinctly annunciate the trouble conditions. These conditions shall as a minimum include:
   a. The number of an IDC in trouble.
   b. Multiple IDCs in trouble shall be annunciated by scrolling the number of the zones in chronological order. Scrolling shall be automatic with manual intervention as required to hold and scroll.
   c. NAC 1 or NAC 2 trouble.
   d. Annunciator interface module trouble.
   e. Auxiliary alarm output trouble, indicated by zone.
   f. Low battery.
   g. Depleted battery.
   h. Walk Test system test enabled.
   i. Programming trouble.
   j. Power supply trouble.
   k. Ground fault trouble.
   l. City Circuit module trouble.
5. The following features shall be selectable at the control panel without using any separate programming tools or equipment:
   a. March time code, temporal code, selective code, zone code, general alarm, time limit cutout, and alarm silence inhibit, for NACs.
   b. Combination Waterflow/Sprinkler operation, that provides distinctive signals for Waterflow Alarm, Sprinkler Supervisory, and Trouble conditions on the system, shall be selectable by zone.
   c. Silence inhibit of the alarm Notification Appliances for 0, 1, 2, 3, 4, or 5 minutes to prevent accidental silencing of the alarm signals.
   d. Selectable NAC Silence cutout timer to automatically silence the Notification Appliances after 0, 10, 20, or 30 minutes after the activation of the Initiating Device.
   e. System Walk Test operation that shall allow the system to be tested by a single person. When in the Walk Test mode, activating an Initiating Device shall report its individual resident zone with a distinct zone code pattern over the audible Notification Appliances. Upon completion of the zone identification, the control panel shall automatically reset within 4 seconds. Integrity of the installation conductors of Initiating Device and Notification Appliance Circuits shall be verified by momentarily opening any circuit. This shall cause the operational Notification Appliances to operate steady for 4 seconds. The control panel shall automatically reset upon completion of the audible test signal. Walk Test of ground fault circuit testing shall be verified by operating the Notification Appliances for 4 seconds.
6. Remote Supervising Station output circuits (City Connection circuits), selectable for interface to remote station reverse polarity, or local energy master box.
7. An internally mounted Digital Alarm Communicating Transmitter (DACT) capable of being programmed for communications with up to two telephone circuits and with programmable local AC power fail time delay reporting.

8. Provisions for interfacing to Emergency Control relays, with dry contact outputs, for control of the HVAC equipment, elevators, door controls and other fire related equipment.
9. Provisions for interfacing to a remote Trouble relay for operation of remote trouble notification appliances.
10. Provisions for interfacing to a remote Supervisory relay for operation of remote supervisory notification appliances.
11. Selective zone disconnect operation shall be provided for each Initiating Device Circuit in the system. The panel shall provide an "Abort Enable" feature that delays the activation of alarm outputs if a zone is re-enabled in the alarm state. This shall allow the operator to "Abort the Enable" prior to unwanted activation of the notification appliances, off-premise reporting, and emergency control relays.

C. The power supply shall provide up to 4 amps of power to serve detectors, alarm notification appliances, remote annunciators, door holders, smoke dampers, relays, and other auxiliary devices as indicated on the plans and specifications. In addition to the 4 amps of power for Notification Appliances and Auxiliary equipment, the panel shall provide adequate power to serve the maximum configuration of control panel modules.

D. A "Depleted Battery" warning shall be sounded in the event that operation on battery back-up exceeds the capacity requirements of the stand-by batteries. Operation shall include activation of the audible tone-alert and a unique indication shall be displayed on the operator control panel.

E. A remote annunciator shall be provided when shown on the plans to indicate an alarm condition for each Initiating Device Circuit via red LED's, that shall flash on alarm, and light steady upon acknowledging the alarm. Space shall be provided on the annunciator for custom zone labels.

2.03 Manual Pull Stations

A. Description: Single- or double-action type, red LEXAN or metal finished in red, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

2.04 Smoke Detectors

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:

1. Environmental Compensation: The detector shall provide a software filtering process that automatically compensates for environmental factors and component aging that affect detector operation.
2. Each detector head shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the detector head LED shall be on steady.

B. Type: Smoke detectors shall be of the photoelectric type, Simplex model number 4098-9601 with a 4098-9788 detector base. Where acceptable per manufacturer specifications, ionization type detectors may be used.

C. Duct Smoke Detector: Photoelectric type, Simplex model number 4098-9686 , with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied.

1. The detector shall provide on-board sensitivity drift compensation and dirt accumulation

tracking

2. A magnetic test function shall initiate an alarm and provide detailed diagnostic information using the detector status LED.
3. The detector shall provide a multi-function status LED indicator that indicates off-normal conditions by specific identifiable detector LED pulse patterns.
4. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC or an auxiliary alarm relay with two "Form C" contacts rated at 1A@ 28VDC or ½A@ 120 VAC resistive. This auxiliary relay operates when the detector reaches its alarm threshold. Relay shall be mounted within 3 feet of HVAC control circuit.
5. Duct detectors installed for smoke damper operation shall operate at no flow conditions.
6. Duct Housing shall provide a relay control trouble indicator Yellow LED.
7. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
8. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke detector.
9. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
10. Each duct detector shall have a Remote Test Station with an alarm LED and test switch.

2.05 Heat Detectors

A. Thermal Detector: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated. Simplex model number 4098-9613 with a 4098-9788 detector base.

B. Thermal detector 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.

2.06 Magnetic Door Holders

A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develops a minimum of 25 lbs. holding force. Simplex model number 2088-9608.

B. Material and Finish: Match door hardware.

2.07 Standard Alarm Notification Appliances

A. Horn: Piezoelectric type horn shall be listed to UL 464. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings. Simplex model number 4901-9820.

B. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.

C. Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated

lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings.

D. Speaker/Visible: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480.

1. Twisted/shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC using and UTP conductors, having a minimum of 3 twists per foot is required for addressable strobe connections.
2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
3. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.
4. The S/V installs directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2" extension

E. Speaker: Speaker notification appliances shall be listed to UL 1480.

1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted / shielded wire.
2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
3. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.
4. The S/V installs directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2" extension

F. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with [an On Steady][a Temporal Code Pattern][a March Time cadence] operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.

G. Accessories: The contractor shall furnish the necessary accessories.

2.08 Fire/Smoke Damper Interface

A. Relays shall be provided for smoke and combination fire/smoke dampers. Smoke dampers shall close upon signal from fire alarm system.

2.09 Fire Alarm Wire and Cable

A. All wire and cable shall be in strict compliance with local codes and the provisions of NEC Article 760 for Power-limited Fire Alarm Circuits. If required, the installation and control panel may be reclassified as Non Power-limited, per the provisions in NEC 760, providing all the requirements of NEC 760 Circuit Markings and Wiring Methods are met, and all identification of Power-limited circuits are removed from the control panel.

B. Unless noted otherwise, all cable not installed in conduit shall be plenum rated.

PART 3 EXECUTION

3.01 Installation, General

A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

3.02 Equipment Installation

A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

3.03 Field Quality Control

A. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

B. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

C. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.

D. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

E. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.

F. Final Test, Certificate of Completion, and Certificate of Occupancy:

1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

3.04 Cleaning and Adjusting

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.

B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.05 Training

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.

1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
2. Schedule training with the Owner at least seven days in advance.

End of Section 28 31 01

SECTION 311100
CLEARING AND GRUBBING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 specifications, apply to this Section.

1.2 SUMMARY

A. The work consists of:
   1. Clearing and grubbing
   2. Removing, and disposing of vegetation
   3. Temporary Erosion Control

1.3 DEFINITIONS

A. Clearing: Clearing shall consist of felling, trimming, or cutting of trees into sections and the satisfactory disposal of the trees and other vegetation, including downed timber, snags, brush, and rubbish within the construction areas. Trees, stumps, roots, brush, and other vegetation in the areas to be cleared shall be cut below the original ground surface.

B. Grubbing shall consist of the removal and disposal of stumps, roots larger than two inches in diameter and matted roots from any designated areas to be grubbed. This material, together with logs and/or other organic debris, shall be excavated and removed to a depth of not less than 12 inches below the original surface of the ground or 12 inches below proposed construction limits, whichever is lower.

C. Trees and Brush: Vegetable growth six (6) inches in diameter and larger, measured three (3) feet above ground shall be classified as a tree. Vegetable growth less than six (6) inches in diameter that is measured three (3) feet above ground shall be classified as brush.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall establish the general temporary construction easements, permanent easements, and construction limit areas.

B. All clearing and grubbing shall be carried out well in advance of the construction operations to not delay the progress of the work.

3.2 PROTECTION OF EXISTING FACILITIES

A. The Contractor shall be responsible for protecting any improvement of any agency, public or private near the clearing and grubbing operations.

B. The Contractor shall notify all utility company owners prior to commencement of work in an area

where that utility has facilities.

3.3 PROGRESS OF CLEARING AND GRUBBING OPERATIONS

A. The Contractor shall clear areas designated timber and wooded areas of trees twenty-five (25) inches in diameter and smaller, with approval of the Engineer.

B. The Engineer and Contractor shall use discretion regarding the removal of timber from within all easement areas so long as the Contractor has adequate access to the area for construction. Individual trees, groups of trees and other vegetation within the above limits shall be left standing and undamaged when so directed by the Engineer.

C. All trees to be removed shall be shown on the plans and shall be marked by the Engineer in the field prior to beginning construction.

D. Any trees determined by the Contractor and Engineer during the construction operations that can be saved and not impede the construction operations shall be saved regardless of size and how denoted on the plans.

3.4 PROTECTION OF TREES AND SHRUBS

A. The Contractor shall leave in place and protect from damage during his operations all trees, shrubbery and flower beds designated by the Engineer.

B. Where trees existing on the project site are not to be removed, it shall be the Contractor's responsibility to trim low branches which will interfere with the normal operation of his equipment.

C. The Engineer shall review tree branches to be removed to coordinate with the property owners affected.

D. The trimming shall be performed in a professional manner, prior to his machine operations, as ordered by the Engineer.

E. All ornamental trees and shrubs required to be disturbed for construction operations shall be removed, protected and replanted at the Contractor's expense.

F. Surfaces of trees or shrubs that are cut or scarred by the Contractor shall be painted with an approved asphaltic base paint prepared especially for tree surgery.

G. When trenching in or near the root system of a protected tree, that part of the trench shall be given priority in backfilling.

3.5 BACKFILLING THE SITE

A. Depressions, holes or pits created by grubbing operations shall be filled with suitable material and compacted in accordance with these Specifications.

3.6 DISPOSAL OF MATERIAL

A. All trees, vegetation, or other cleared and grubbed material shall be removed from the project site and disposed of in accordance with local laws.

B. Material may be disposed of in any location approved by the Engineer. If disposal is on private

property, the Contractor shall obtain written permission from the property owner on whose property the material is to be placed.

C. The Contractor shall provide the Engineer with a copy of all agreements with property owners.

END OF SECTION

SECTION 312313
SUBGRADE SCARIFYING, COMPACTION AND PREPARATION

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. The work shall consist of preparing the subgrade

PART 2 PRODUCTS

2.1 MATERIALS

A. Earth backfill shall be earth previously excavated from the roadbed, free from perishable matter, frozen soil, stone over six (4) inches in its largest dimension and other matter liable to become unstable when saturated with water and compacted.

B. Where previously excavated earth is determined by the Engineer to be unsuitable for backfill, the Contractor shall obtain and place earth from an approved source.

C. Granular backfill shall meet the requirements of SECTION 312333 of these specifications.

PART 3 EXECUTION

3.1 SCARIFYING SUBGRADE

A. Where subgrade scarifying is specified by the Engineer, the Contractor shall perform all work necessary to loosen the surface of the roadbed over its full width to a full depth of six (6) inches below the finished grading section and remove all rocks larger than four (4) inches.

B. Oversize material shall be disposed of as directed by the Engineer.

C. After all the oversize material has been removed, the roadbed shall be brought back to a satisfactory grade and cross section by the addition of extra material, if needed, without rocks that exceed four (4) inches.

3.2 SUBGRADE COMPACTION

A. The subgrade for the full width of the roadbed shall be scarified to a depth of at least six (6) inches, and the scarified material brought to uniform moisture content either by drying or by adding water and manipulating with suitable equipment.

B. At the Contractor's option, the upper six (6) inches of soil may be removed and replaced with satisfactory or removed and manipulated with suitable equipment before replacing.

C. The material shall be compacted to produce a subgrade having a density not less than that outlined in the Geotechnical Report using approved equipment producing satisfactory results.

D. If it is determined, that the required subgrade density cannot be obtained by moisture control and compaction of the upper six (6) inches, the unsuitable material shall be excavated to a depth of eighteen (18) inches and replaced with satisfactory material compacted in depths of six (6) inches, except as otherwise permitted by the Engineer.

E. Each six (6) inch layer shall be processed, wetted or dried as necessary, and compacted to the required density.

F. If an unsatisfactory subgrade has developed through negligence on the part of the Contractor, he shall be required to restore it to a satisfactory condition at his expense.

3.3 SUBGRADE PREPARATION

A.The subgrade shall be substantially uniform in density throughout its entire width.

B. It shall conform to the lines, grades, and typical cross sections shown on the plans or as established by the Engineer.

C. The subgrade shall be constructed to drain surface water to side ditches and all ditches shall be kept open by the Contractor.

D. Where hauling results in ruts or objectionable irregularities, the Contractor shall reshape and reroll the roadway before the base or surfacing is placed.

E. If an old traveled roadway comprises any part of the roadbed, the Contractor shall loosen the compacted portion to a depth of at least six (6) inches and shall reshape the roadbed.

F. All subgrades, except those for aggregate type surfacing, shall be rolled.

G. The subgrades shall be checked after rolling and, if not at the proper elevation at all points, enough material shall be removed or added and compacted to bring all portions of the subgrade to the required elevation and density.

H. The moisture content of the top six (6) inches of the finished subgrade at the time the base is placed, or at the time the pavement is placed if no base is provided under the pavement shall be as outlined in Table 1.

I. If the moisture content has not been maintained, the subgrade shall be scarified, wet to the required moisture content, and compacted.

J. A roughly compensating maximum deviation of one-half (1\2) inch, plus or minus, from the required elevation will be permitted on the surface of the finished subgrade.

K. Prior to laying base or setting pavement forms, the subgrade shall conform to the moisture and density requirements for compaction in Table 1.

L. Soft spots and unsuitable material shall be removed to a depth of twenty-four (24) inches and backfilled with approved stable material.

M. The subgrade for portland cement concrete pavement shall be compacted and brought to true shape by an approved subgrade machine.

N. Any material added shall be satisfactorily incorporated and compacted.

O. Before the concrete is placed, a true subgrade section shall be shaped by an approved subgrade planer rolling on the forms and any resulting loose material on the subgrade behind the planer shall be recompacted by a five (5) ton steel wheel roller.

P. The planer shall be adjusted to produce a subgrade to the exact elevation and cross section.

Q. After all grading and planing operations have been completed, and immediately before the concrete is placed, the subgrade shall be checked with an approved heavy metal template which shall be rolled on the forms.

R. Scratch templates with spikes or teeth will not be permitted. A taut line across the side forms and a ruler may be used in lieu of a template for checking the subgrade on irregular areas or variable widths.

S. Extreme care shall be taken in forming the crown and shaping the subgrade to ensure that the specified thickness of concrete will be attained in the finished pavement. The finished subgrade at the time of the paving shall be moist, but sufficiently firm to resist rutting or deforming under construction traffic.

Table 1

Areas of Fill Placement	Material	Min. Compaction Requirements	Moisture Content (% of Optimum)
Granular Layer (4” Beneath floor Slab)	ASTM C-33, #57 Stone	65% of Relative Density	As Necessary to Obtain Density
Low Volume Change (18” below the base of granular in floor slabs)	LL < 50 PI < 25	95%	0 to +4 Percent
	MoDOT Type 5 Baserock	95%	As Necessary to Obtain Density
Structural Fill – On Site	On-Site Cherty Clay Soils	95%	0 to +4 Percent
Structural Fill - Imported	LL < 60 PI < 30 Min. 35% Chert Retained on No. 4 Sieve	95%	0 to +4 Percent
Pavement Subgrade – 12” below the base of the pavement or aggregate base	LL < 50 PI < 25 Min. 35% Chert Retained on No, 4 Sieve	95%	0 to +4 Percent
Aggregate Base for Pavement	MoDOT Type 5 Baserock	95%	As Necessary to Obtain Density

END OF SECTION

SECTION 312316.16
STRUCTURE EXCAVATION AND BACKFILL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.2 SUMMARY

A. The work shall consist of
   1. excavating the foundations of all structures
   2. the removing and disposing of all excavated materials
   3. the backfilling around the completed structures

PART 2 PRODUCTS

2.1 MATERIALS

A. Material used for embankment shall be material excavated at the project site and free of trees, stumps, rubbish and other deleterious material.

B. Topsoil stripped, stored, and placed shall be fertile, friable, with liberal content of humus, and capable of sustaining vigorous plant growth. If the stripped topsoil is not adequate to complete the work, enough topsoil shall be furnished and shall be a natural, fertile, friable soil, possessing characteristics representative of productive soils in the vicinity.

   1. It shall be obtained from naturally well-drained areas. It shall not be excessively acid or alkaline (except for those plants requiring acid soil) nor contain toxic admixture of subsoil and shall be cleaned and reasonably free from clay lumps, stumps, roots, or similar substances, debris, or other objects which might be hindrance to placing operations.

PART 3 EXECUTION

3.1 FOUNDATION PREPARATION

A. Methods used in excavating for foundations of structures shall insure maintaining the stability of the material adjacent to the excavation.

B. Care shall be taken to avoid disturbing the material below the bottom of the footings where the structure is founded on material other than rock, and final removal to grade shall not be made until just prior to placing concrete.

C. Foundations for structures and retaining wall shall be free of loose, shalely, or disintegrated rock, and the footing shall be placed on undisturbed material.

D. Concrete footings for structures shall be placed on reasonably dry foundation material.

   1. Footings shall be keyed not less than 6 inches into hard, solid rock and not less than 18 inches into soft rock or shale or the suitable material specified for spread footings.

2. Excavation in rock or shale for the key shall be made as near as practicable to the size of the footing, or of the key as shown on the plans.

3. When placing the footing, the key portion shall be cast against the vertical, undisturbed face of the rock or shale.

4. If side forms are necessary for footings, they shall be removed approximately 24 hours after placing the concrete, and the excavation immediately backfilled to the top of the footing.

5. All cavities or crevices shall be cleaned out and filled with concrete.

6. All holes, pits, or sumps resulting from excavating operations shall be kept drained or pumped out until the completion of the work. No ponding of water around footings on other than rock will be permitted.

3.2 ROCK ENCOUNTERED IN EXCAVATION

A. If rock is encountered under a portion of the bottom slab of a concrete box-type structure, the rock shall be removed to at least 6 inches below the bottom of the slab and curtain walls and backfilled with material like that under the remainder of the structure.

3.3 SHEETING, SHORING OR BRACING

A. Sheeting, shoring or bracing shall be placed by the Contractor wherever necessary for the proper preserving of any excavation, embankment or structure.

B. Where the ground is of such a character or other conditions are such as to render it necessary, the sheeting shall be closely driven and to such depth below the lowest point of the final excavation as may be required.

C. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used and for property damaged as the result of improper quality, strength, placing, maintaining or removing the same.

D. No extra compensation will be made for sheeting and bracing whether left in place or removed.

E. The Contractor shall, at his own expense, shore up, protect and insure from injury all building, retaining walls, piers and footings. storm sewers, sanitary sewers, gas lines, water lines, fences, curbs, streets or other property liable to be injured during the process of the work, and he will be held responsible for all damage which may occur by reason of prosecution of the Work.

F. Sheeting, shoring and bracing shall be provided, installed, and maintained to protect the excavation and insure open trench operations.

3.4 COFFERDAMS

A. Cofferdams shall, in general, be carried well below the bottom of the footings, and shall be well braced and as watertight as practicable.

B. The interior dimensions of cofferdams shall provide enough clearance for the construction of forms and ample room for a sump and for pumping outside the footing forms.

C. Cofferdams which have been tilted or moved laterally during the process of sinking shall be

corrected to provide the necessary clearance.

D. They shall be constructed to protect the work against damage from sudden rising of the stream and to prevent damage to the foundation by erosion.

E. Cofferdams, with all sheeting and bracing, shall be removed after the completion of the substructure unit, unless specific authority is given for then to be left in place.

F. The Contractor, upon request, shall submit drawings showing his proposed method of cofferdam construction and other details open to his choice or not fully shown on the plans.

G. Pumping from the interior of any foundation enclosure shall be done in a manner to preclude the possibility of the movement of water, or other fluids or semi-fluids, through any fresh concrete.

H. If necessary, the footing form shall be made watertight and shall be sealed around the bottom, and all pumping done between the footing form and the wall of the enclosure.

3.5 SEAL COURSES

A. Seal courses will be required if indicated on the plans or if conditions are encountered which, in the judgment of the Engineer, render it impracticable to dewater the foundation area.

B. Pumping will not be permitted while excavating, driving piling, or placing the seal course, and not until, by determination of the Engineer, the seal course has attained enough strength to withstand the hydrostatic pressure.

C. If seal courses are shown on the plans, and it develops that the footings may be satisfactorily placed without sealing, the Contractor will be required to dewater any completed excavation for investigation purposes.

D. Seal courses, other than those on the plans, will not be authorized or permitted except for extreme cases where it is impracticable to dewater the footing area by other means, and then only with the written permission of the Engineer.

3.6 BACKFILL

A. Backfill material shall be of an acceptable quality and shall be free from large or frozen lumps, wood, or other extraneous material.

B. All spaces excavated and not occupied by the new structure or by porous backfill shall be refilled with earth to the original ground surface or to the finished ground lines shown on the plans.

C. All backfill shall be thoroughly compacted and its top surface neatly graded.

D. Backfill placed around culverts and piers shall be kept at approximately the same elevation on opposing sides.

E. Drains consisting of 5 cubic feet of coarse aggregate shall be placed at weep holes except where porous backfill is required.

F. Backfill material shall not be placed against end bents of bridges, sides of box culverts, or back of retaining walls until the concrete has attained the specified strength.

G. Special precaution shall be taken to prevent any wedging action against any masonry walls.

H. Backfill material shall not be placed higher behind than in front of end bents until the superstructure is in place.

I. The backfill at end bents, walls, or other units which falls within the limits of a roadbed shall be placed in successive 6-inch layers and compacted to the same density required for the adjacent roadbed.

J. The slope bounding the excavation, if steeper than six horizontal to one vertical, shall be stepped or serrated.

K. Until the grade is in place, drainage shall be maintained away from the end bent back wall by constructing a 6 to one or steeper slope away from the back wall for a minimum distance of 3 feet and providing a lateral path for all water to flow off the roadbed section.

L. Excavation and embankment lying adjacent to tunnels, basements and retaining walls shall be extended six feet beyond the outside of the structure and sloped back on a 1 to 1 slope.

M. Adequate backfill material shall be stockpiled as close to the structure a possible without interfering with other ongoing work.

3.7 UNSUITABLE MATERIAL

A. Excavated material which is unsuitable for backfill and embankments, and excess material not required for either, shall be disposed of.

B. It shall not be dumped into the channel of a stream without the written authorization of the Engineer.

3.8 FOUNDATION STABILIZATION AND TESTS

A. The Contractor shall furnish and place sand, rock, gravel, or other suitable backfill material to replace unsuitable material encountered below the foundation elevation of the structures.

B. He shall stabilize suitable foundation material or form the bottom of pile footings if necessary to obtain a stable foundation.

C. He shall furnish assistance in driving sounding rods or drilling test holes to permit an adequate inspection of the foundation.

D. The depth of the excavation, the character of the material, and the condition if the foundation shall be approved by the Engineer before any concrete is placed in the footing.

E. A testing frequency of one field density for each 2500 square foot of fill lift within building areas and one field density for each 5000 square foot of fill lift for all other areas is required.

F. Moisture content shall be as specified in Table 1 of Section 312313. All testing shall be the responsibility of the Contractor.

3.9 CLASSIFICATION

A. All material excavated shall be considered as unclassified excavation which shall consist of all material of whatever character encountered in the work, including soil, solid rock, fragmented rock, water, or other.

3.10 FINISH GRADING

A. All areas disturbed by the excavation and backfilling operations shall be machine graded with a small tractor equipped with a box blade or similar equipment.

B. All rocks larger than three inches in diameter shall be removed. Tolerance shall be $\pm$ 0.05 foot.

END OF SECTION

SECTION 312333
TRENCH EXCAVATION, BACKFILL AND COMPACTION

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. The work shall consist of

1. Excavation of trenches, pits and associated incidental elements
2. Backfilling of these excavations

PART 2 PRODUCTS

2.1 MATERIALS

A. Earth backfill shall be earth previously excavated from the trench, free from perishable matter, frozen soil, stone over six (6) inches in its largest dimension and other matter liable to become unstable when saturated with water and compacted.

B. Bedding material shall be well graded, crushed stone or gravel meeting the requirements of ASTM C33, Gradation 8, ½ inch to No. 16 size. Chat meeting these requirements may be used with the written permission of the Engineer.

C. Select granular backfill shall be well-graded, crushed stone or gravel meeting the requirements of ASTM C33, Gradation 67, 1 inch to No. 8 size.

D. Topsoil stripped, stored, and placed shall be fertile, friable, with liberal content of humus, and capable of sustaining vigorous plant growth.

1. If the stripped topsoil is not adequate to complete the work, sufficient topsoil shall be furnished and shall be a natural, fertile, friable soil, possessing characteristics representative of productive soils in the vicinity.

2. It shall be obtained from naturally well-drained areas.

3. It shall not be excessively acid or alkaline (except for those plants requiring acid soil) nor contain toxic admixture of subsoil and shall be cleaned and reasonably free from clay lumps, stumps, roots, or similar substances, debris, or other objects which might be hindrance to placing operations.

PART 3 EXECUTION

3.1 TRENCH EXCAVATION

A. All trench excavation shall be made with a sufficient working space to permit the placing, inspection, and completion of all work contemplated in the contract.

B. Excavated material that is unsuitable for backfill and all boulders exposed by trenching shall be

removed from the work area.

C. Trench excavation shall in all cases be continuous from the ground surface to the established trench depth.

D. Materials excavated shall be stockpiled at the sides of the trench and within established area limits so as to minimize inconvenience to the public and damage to vegetation and structures in the area.

E. When unstable ground is encountered, the trenching shall be carried out utilizing trench shoring, bracing and shields to prevent cave-ins.

F. Trench width from six inches below the pipe flow line to six inches above the pipe joint shall be held to 24" minimum or 1.4 times the pipe O.D. plus 12 inches.

G. Trench width above these levels may be wider to accommodate shoring, bracing and shields, but shall be kept within practical limits and shall be subject to the Engineer's approval.

3.2 ROCK EXCAVATION

A. Rock excavation shall include the removal of all limestone, sandstone, flint, granite, quartzite, slate, hard shale or similar material measuring ½ cubic yard or more in volume, requiring systematic drilling or blasting for their removal.

B. Rock locally known as joint flint will not be included in rock excavation. Rock excavation shall consist of the removal of stone in ledges six (6) inches thick or more.

C. A ledge will be considered to be a continuous deposit of rock that may or may not include thin, interbedded seams of soft material, joint flint or shale.

D. The vertical limits of the ledge shall be determined by beds of soft material, joint flint or shale more than twelve inches thick.

E. The beds of soft material, joint flint or shale will be included in the measurement of common excavation only.

F. Boulders or other detached stones each having a volume of two cubic yards or more will be considered as rock excavation.

G. Where it is necessary to place pipe in rock excavation, the rock shall be removed to provide a minimum clearance, for the size of pipe being laid as follows:

SIZE OF PIPE	DEPTH BELOW PIPE	MINIMUM SIDE CLEARANCE
21" and Smaller	6"	6"
24" and Larger	9"	9"

H. The clearance figures shown are minimum clearances from the closest projection of the rock to the outside edge of the pipe and are not average figures.

I. All material removed from the trench in order to provide the above clearance shall be replaced below and at the side of the pipe with granular bedding material as specified in these Specifications.

3.3 LINES AND GRADE FOR TRENCH EXCAVATION

A. The Contractor shall furnish and set all stakes for the lines as shown on the plans.

B. The Contractor shall be held responsible for verification of lines as established and shown on the plans.

C. The Engineer may check the line and depth at any given point in the trench. The Contractor shall furnish and set up for underground construction, all batter boards required therefore and shall provide all required labor for setting stakes and boards

3.4 SHEETING, SHORING OR BRACING

A. Sheeting, shoring or bracing shall be placed by the Contractor wherever necessary for the proper preserving of any excavation, embankment or structure.

B. Where the ground is of such a character or other conditions are such as to render it necessary, the sheeting shall be closely driven and to such depth below the lowest point of the final excavation as may be required.

C. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used and for property damaged as the result of improper quality, strength, placing, maintaining or removing the same.

D. No extra compensation will be made for sheeting and bracing whether left in place or removed.

E. The Contractor shall, at his own expense, shore up, protect and insure from injury all building, retaining walls, piers and footings, storm sewers, sanitary sewers, gas lines, water lines, fences, curbs, streets or other property liable to be injured during the process of the work, and he will be held responsible for all damage which may occur by reason of prosecution of the Work.

F. Sheeting, shoring and bracing shall be provided, installed, and maintained to protect the excavation and insure open trench operations.

3.4 PIPE BEDDING INSTALLATION

A. Granular stone shall be placed in the trench and shaped to provide uniform support for the bottom quadrant of the pipe barrel.

B. The bedding layer under the pipe shall be not less than six (6) inches in thickness or one fourth the inside diameter of the pipe for pipe over 24 inches in diameter.

C. Following the placement of the pipe, the trench shall be filled with granular bedding material to the depth specified by the plans.

3.6 BACKFILLING

A. Material used for backfilling shall be free from perishable matter and from other material liable to become unstable when saturated with water after having been compacted.

B. No frozen materials shall be used in the backfill.

C. Care shall be taken to prevent damage to the pipe and structures. Special precautions shall be taken in backfilling over pipes.

D. No backfill shall be placed over any portion of pipes and/or joints not inspected by the Engineer.

E. Backfill shall be carefully deposited in uniform layers not exceeding six inches in depth and each layer shall be carefully and solidly tamped with mechanical tampers in such a manner as to avoid damage to pipe or disturbing the completed work.

F. Backfill material above the pipe bedding in the remainder of the trench shall use previously excavated gravel, sand, or earth, and containing no stone over six (6) inches in its largest dimension.

G. Stones below that size may be used in proportion not exceeding one part of stone and three parts of earth in any place.

H. Where trenches are excavated within the limits of existing or proposed street improvements, the trenches shall be backfilled with granular material meeting the requirements these Specifications.

I. The length of the granular backfill shall extend from the back of curb to back of curb or edge of pavement to edge of pavement within the proposed or existing street construction or as designated on the plans.

J. The backfill shall be placed in the trenches to the top of the trench flush with the adjacent ground.

K. Where the trench crosses existing street or parking areas, after backfilling operations are complete, and as soon as is practical, the driving surface shall be repaired.

L. Where pipe lines are placed in trenches along or across existing crushed stone or gravel surfaces, the entire depth of trench shall be backfilled with granular stone. The material shall be compacted to a density of not less than 95% maximum density.

M. Where pipe lines are placed in trenches along or across existing chip and seal asphaltic surfaces, the entire depth of trench except the top three inches shall be backfilled with granular stone and compacted to 95% maximum density.

N. The top three inches of trench shall receive asphaltic concrete. The asphaltic concrete shall be compacted to 100% Marshall Density.

O. Where pipe lines are placed in trenches along or across an existing asphalt surface, the entire depth of trench shall be backfilled with granular stone and compacted to 95% maximum density.

P. The top three inches of trench shall receive asphaltic concrete. The asphaltic concrete shall be compacted to 100% Marshall density.

Q. Where pipe lines are placed in trenches along or across an existing concrete surface, the entire depth of trench shall be backfilled with granular stone and compacted to 95% maximum density.

R. The top eight inches of trench shall receive concrete and receive a stiff broom finish.

S. Where the trench crosses proposed or future street or parking areas, the trench shall be backfilled with granular material to the top of the trench flush with the adjacent ground surface.

T. No additional surface repair work will be required other than that specified for necessary clean up of the disturbed areas.

3.7 UNSUITABLE MATERIAL

A. Whenever in the opinion of the Engineer the material excavated from the trenches is not suitable for backfilling or there is a deficiency of material, the Contractor shall at his own expense provide suitable material from an approved source.

3.8 GROUNDWATER

A. When groundwater is found which, in the opinion of the Engineer, affects the usefulness or satisfactory operation of any of the permanent work, he may direct special provisions to be taken.

3.9 INSPECTION

A. After completion of excavations, the Contractor shall notify the Engineer that the trench or excavation may be inspected; and prior to placement of materials other than shoring, bracing or sheeting, the excavation shall be observed by the Engineer.

3.10 FIELD QUALITY CONTROL

A. All backfill shall be deposited and spread in layers and solidly tamped to 95 percent of maximum density as determined by ASTM D698.

B. Density of compacted backfill shall be determined by an independent testing laboratory.

C. Density shall be determined by ASTM D6938, latest revision.

D. If test results indicate required densities have not been attained, compaction shall continue and soil retested until density is achieved.

E. The Contractor shall be responsible for all testing.

3.11 CLEANING OF RIGHT-OF-WAYS AND EASEMENTS

A. All excess excavation materials or blasting debris shall be cleaned up by the Contractor as directed.

B. As the trenches are backfilled, the Contractor shall remove all surplus material and regrade the surface leaving all rights-of-way and streets clear and in good order.

C. Upon completion of any portion of the Work, all the land and right-of-way shall be cleaned of all surplus material, earth, rubbish, etc., and left in a condition acceptable to the Owner.

D. At all times adequate clean-up shall be provided to enable normal passage of traffic to occur on all streets, alleys, and private driveways.

3.12 PROTECTION OF ADJACENT PROPERTY

A. The Contractor shall protect all excavations and trenches from settlement or displacement by approved means of bracing and shoring.

B. All existing underground utilities and structures and surface improvements and structures shall be protected and their functional purpose preserved.

3.13 MAINTENANCE PERIOD FOR BACKFILLED TRENCHES

A. All backfilled trenches shall be maintained by the Contractor for a period of one year after acceptance of the work by the Owner.

B. Where required due to settlement of the trench, the Contractor shall fill the trench to the same level as the adjacent unsettled area and make any repairs to the disturbed area as required by the Engineer and the property owner.

C. All work required for repair of the settled trenches during the maintenance period shall be at the Contractor's expense and no additional payment will be made.

3.14 CLASSIFICATION

A. All material excavated shall be considered as unclassified excavation which shall consist of all material of whatever character encountered in the work, including soil, solid rock, fragmented rock, water, or other.

END OF SECTION

SECTION 321123
AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 specification section, apply to this section.

1.2 DESCRIPTION

A. The work shall consist of placing aggregate on a prepared subgrade

PART 2 PRODUCTS

2.1 MATERIAL

A. Aggregate for base course shall meet the requirements of Type 5 aggregate material as specified in Section 1007 of the Missouri Standard Specifications for Highway Construction, latest edition.

PART 3 EXECUTION

3.1 SUBGRADE

A. All work on that portion of the subgrade on which the base is to be constructed shall be completed in accordance with the requirements of Section 312313 of the Specifications prior to the placing of any base material on that portion.

B. Aggregate base shall not be placed on a frozen subgrade.

3.2 PLACING

A. The maximum compacted thickness of any one layer shall not exceed six (6) inches.

B. When the specified compacted depth of the base course exceeds six (6) inches, the base shall be constructed in two or more layers of approximately equal thickness.

C. The compacted depth of a single layer of the base course may be increased to eight (8) inches for shoulders and lightly traveled areas.

D. After preliminary compaction has been secured, finish compaction shall be carried to completion by means of self-propelled steel-wheeled rollers weighing not less than ten (10) tons.

E. Shaping and compacting shall be carried on until a true, even, uniform base course of proper grade, cross section and density is obtained.

F. Proper moisture content shall be maintained by wetting the surface or allowing it to dry as required during shaping and compacting operations.

G. The use of excess water, resulting in run-off or in the formation of a slurry on the surface shall be avoided.

H. The stone base shall be compacted to the density outlined in Table 1 of Section 312313.

3.3 TESTING

A. The compacted base shall be tested for in place density by ASTM Method D6938 latest revision.

B. The Contractor shall be responsible for all testing.

3.4 TOLERANCE

A. The compacted base shall be brought to within a tolerance of 1\2 inch or less below design grade.

B. The compacted aggregate base thickness shall not be deficient more than 1\2 inch from the plan thickness.

C. Thickness measurement shall be taken and determined for each 800 square yards of base surface or as designated by the Engineer.

END OF SECTION

SECTION 321623
SIDEWALKS AND EXTERIOR CONCRETE SLABS

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 DESCRIPTION

A. The work shall consist of construction of concrete sidewalks and exterior concrete slabs

PART 2 PRODUCTS

2.1 MATERIAL

A. Concrete shall meet the requirements of Type X Concrete as specified in Section 033000 of the specifications.

B. WELDED WIRE REINFORCEMENT: Welded wire reinforcement shall be 6”x6” – W2.9xW2.9 and shall comply with the requirements of ASTM A1064.

C. FIBER MESH REINFORCEMENT: Fiber reinforcement shall comply with the requirements of ASTM C1116 for Type III synthetic-fiber reinforcement.

1. The synthetic reinforcing fibers shall be 100 percent virgin polypropylene fibrillated fibers containing no reprocessed olefin materials.

2. Fibers shall have a specific gravity of 0.9, a minimum tensile strength of 70 ksi, graded per manufacturer and be specifically manufactured to an optimum gradation for use as concrete reinforcement.

3. Provide a minimum of 1.5 pounds of synthetic fiber mesh reinforcement per cubic yard of concrete. The fibers shall be added at the batch plant.

PART 3 EXECUTION

3.1 GENERAL

A. Mix, place, reinforce, finish and cure concrete in accordance with Section 033000 of these specifications.

3.2 JOINTS

A. Provide one-half (1/2) inch pre-molded asphalt expansion joint material full depth of concrete where abutting curbs, slabs, pavement and buildings.

B. The contraction joints shall be one-eighth (1/8) inches wide by 1 inch deep and may be formed by inserting a strip, tooling or by use of a concrete saw.

C. The maximum distance between contraction joints in the sidewalk shall be five (5) feet.

D. The maximum distance between contraction joints in the parking area shall be ten (10) feet unless otherwise approved.

3.2 FORMING

A. Form edges.

B. Moisten fill before placing concrete.

C. Tool edges.

D. Concrete shall be rodded and tamped at the form line to produce a consistent smooth edge when forms are removed.

E. Forms shall be steel or wood, in good condition and acceptable to the Engineer.

F. All forms shall have not more than one-fourth (1/4) inch variation in horizontal and vertical alignment for each ten (10) feet in length.

G. The forms shall be true to line and grade and shall be adequately supported to stay in position while depositing and compacting the concrete.

H. They shall be constructed to permit their removal without damage to the concrete.

3.3 SLAB THICKNESS

A. Sidewalk thickness shall be four (4) inches.

B. The exterior slabs shall be a minimum six (6) inches thick or as specified on the plans.

3.4 FINISH

A. Sidewalks and exterior concrete slabs shall receive a light broom finish after hard steel trowel surfacing.

END OF SECTION

SECTION 329200
SEEDING AND SODDING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplemental conditions and Division 1 Specifications sections, apply to this section.

1.2 SUMMARY

A. The work in this section consists of:

1. Furnishing and placing of topsoil
2. Liming
3. Seeding and sodding
4. Mulching
5. Preparing and establishing uniformly graded areas

PART 2 PRODUCTS

2.1 MATERIAL

A. Topsoil stripped, stored, and placed shall be fertile, friable, with liberal content of humus, and capable of sustaining vigorous plant growth.

1. If the stripped topsoil is not adequate to complete the work, sufficient topsoil shall be furnished and shall be a natural, fertile, friable soil, possessing characteristics representative of productive soils in the vicinity.

2. It shall be obtained from naturally well-drained areas and shall not be excessively acid or alkaline (except for those plants requiring acid soil) nor contain toxic admixture of subsoil and shall be cleaned and reasonably free from clay lumps, stumps, roots, or similar substances, debris, or other objects which might be hindrance to placing operations.

B. Lime shall be ground limestone containing not less than 85% of total carbonates and shall be ground to such a fineness that 50% will pass through a 100-mesh sieve and 90% will pass through a 20-mesh sieve.

1. Coarser material will be acceptable, provided the specified rates of application are increased proportionately based on quantities passing the 100-mesh sieve.

C. FERTILIZER: Commercial fertilizer shall be formula 12-12-12, and shall conform to the applicable state fertilizer laws.

1. It shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis.

2. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.

D.HERBICIDE: Herbicide shall be a per-emergence type for mixing with soil designed to eliminate noxious weeds without harming landscape plants.

E. SEED: The seed shall be of the following mixture with the percentage of purity and germination shown to be the minimum requirements in the acceptance of the seed:

GRASS TYPE	MIXTURE	PURITY	GERMINATION
Kentucky Blue Grass	50%	85%	80%
Creeping Red Fescue	40%	97%	85%
White Clover	5%	98%	85%
Annual Rye Grass	5%	98%	85%

1. The seed shall be free from Johnson Grass, Canadian Thistle, or field bind weed seed, and shall not contain more than two percent of other weed seed.

2. The Contractor shall provide to the Engineer a certificate showing that the seed mixture meets the requirements of this specification.

3. All leguminous seed shall be inoculated or treated with the proper quantity of cultures for that legume to be sown. Leguminous seed include Alsike Clover, Korean Lespedeza, Red Clover, Sericea Lespedeza, Sweet Clover, White Clover, Hairy Vetch, Crown Vetch, and Birdsfoot Trefoil.

F.SOD: Sod shall be densely rooted and thriving, free of all prohibited and noxious weeds as defined by the Missouri Department of Agriculture and reasonably free of all other weeds.

1. The sod shall be grown from seed varieties that are favorable for Missouri climate conditions and may be cut in strips or rolls.

2. Turf type tall fescue and Kentucky bluegrass shall be grown from a blend of three separate varieties for each sod. Buffalograss sod shall be of a variety exhibiting salt tolerance.

3. All sod shall be in accordance with the Missouri Plant Law and the Missouri Department of Agriculture's Code of State regulations regulating the growth, sale and shipping of nursery stock in the state of Missouri.

4. The Contractor shall provide a valid certificate of inspection from the state of origin to the Engineer prior to the placement of any sod.

G. MULCH AND MULCH OVERSPRAY: Vegetative mulch shall be the shredded cereal straw from stalks of oats, rye, wheat, or barley or prairie hay. and shall consist of any combination of any of the following plants: Big Bluestem, Little Bluestem, Indiangrass, Sideoats Gramma and native wildflowers.

1. Mulch may also be from composted material from clearing and grubbing operations.

2. If composted material from clearing and grubbing operations are used the particle size shall be such that it can be adequately spread and does not exceed six (6) inches in length.

3. The mulch shall be free of prohibited weed seeds as stated in the Missouri Seed Law; shall be relatively free of all other noxious and undesirable seeds; and dry enough to spread properly.

4. Mulch overspray shall be either virgin wood cellulose fibers or recycled paper mulch.

5. The mulch shall be produced by either the ground or cooked fiber process, shall not be water soluble and shall have the following properties:

PROPERTY	REQUIREMENT
Moisture Content, percent by weight, max.	15
Organic Matter - Wood Fiber, percent by weight, min.	80
Ph	4.3 - 8.5

H. INOCULANT FOR LEGUMINOUS SEED: The inoculant for treating leguminous seed shall be a pure culture of nitrogen-fixing bacteria.

1. The containers of the inoculant shall be plainly marked with the expiration date for use and the manufacturer's directions for inoculating seed.

PART 3 EXECUTION

3.1 AREA OF COVERAGE

A. All areas within the limits of the construction area, including all rights-of-way and temporary construction easements to areas pertaining to the contract which require grading, contouring, or the filling of embankments shall be planted with grass and mulched.

B. Any disturbed areas outside of the authorized construction limits shall be planted with grass and mulched at the Contractor's expense.

3.2 SOILS TEST

A. The Contractor shall, at his own expense, contact the County Extension Agent and secure a soil test of the topsoil.

B. If recommended by this test, the topsoil shall be limed in quantity recommended by the Extension Agent.

C. (Generally, a soil ph of 6.0 to 6.5 is desirable.) Three copies of the soil test shall be sent to the Engineer along with recommendations on lime use. No work shall be started until approved by the Engineer.

3.3 INOCULATION OF LEGUMINOUS SEEDS

A. The process of inoculation shall be in accordance with the manufacturer's directions for the species of legume.

B. The time lapse for sowing seed following inoculation shall not exceed 24 hours.

C. If hydraulic slurry seeding is used, a quantity of inoculant equal to five times the normal rate

required to inoculate the seed shall be used.

D. The inoculant shall be placed directly into the slurry and thoroughly mixed immediately before seeding.

E. If other than the hydraulic slurry method is used, the legume seed may be inoculated at the normal rate prior to mixing with the other seed.

F. A seed mixture which contains a legume seed that was not inoculated prior to mixing and is not to be seeded by the hydraulic slurry method, shall be inoculated with sufficient inoculant to cover all seed.

3.4 TIME OF PLANTING

A. The Contractor shall coordinate the work so that areas will be top soiled and graded to meet the planting schedule as follows:

Preferred Time of Planting: February 1 to April 20.
Alternate Time of Planting: September 1 to October 30.

B. For this time of planting the Contractor shall keep the grassed area well watered, or until the project is accepted by the Owner.

3.5 HARDSHIP CONDITIONS

A. The Engineer is aware that in some cases, it would create a hardship to maintain the above schedule.

B. If the Contractor wishes to make recommendations on other times when seeding could be done, the Engineer will consider these recommendations.

C. However, methods or time of planting shall be agreed to, in writing, before commencing this portion of the work or the above schedule shall be followed.

3.6 PREPARATION OF SEEDBED

A. The seedbed shall be prepared by loosening the existing soil on the slope, adding the topsoil previously stockpiled, spread and graded to conform to the grades and sections shown on the plans.

B. The soil shall be graded and thoroughly broken up, loosed, tilled and loosened to a minimum depth of two inches.

C. All stones larger than two inches in any direction shall be picked up and removed from the seedbed.

D. All other roots, sticks, hard clumps of dirt, brush or other litter shall be raked up and removed.

E. All areas proposed for receiving seed and mulch shall be covered with a minimum thickness of six (6) inches of topsoil. The total depth of the prepared seedbed shall be a minimum of six (6) inches.

3.7 APPLYING FERTILIZER

A. Commercial fertilizer shall be applied at the rate of 20 pounds per 1,000 square feet to the areas being prepared for planting.

B. Fertilizer may be applied with seed, however, application after sprouting of the lawn seed is preferred.

3.8 SOWING OF SEED

A. Immediately before any seed is to be sown, the ground shall be scarified as necessary and shall be raked until the surface is smooth, friable, and of uniformly fine texture.

B. Seeded areas shall be seeded evenly at the rate of 200 pounds per acre, lightly raked, and watered with a fine spray.

C. The method of seeding may be varied at the discretion of the Contractor on his own responsibility to establish a smooth, uniformly grassed area.

3.9 MULCHING

A. Within 24 hours after seeding, mulch shall be spread evenly over the entire area at the rate of 2.5 tons per acre.

B. The Contractor may at his discretion, place erosion control netting in areas where the seeded area could be damaged.

3.10 CLEAN-UP

A. Any soil, manure, peat or similar material which has been brought onto paved areas by hauling operations, or otherwise, shall be removed promptly, keeping these areas clean always.

B. Upon completion of the planting, all excess soil, stones, and debris which have not previously been cleaned up shall be removed from the site or disposed of as directed by the Engineer.

3.11 MAINTENANCE

A. Maintenance shall begin immediately after planting and shall continue in accordance with the following requirements:

1. Repairs to seeded areas necessary during the maintenance period due to removal, vandalism, or acts of neglect on the part of others may be done on request by the Owner and will be done at the expense of the Owner.

2. Lawns shall be protected and maintained by the Contractor by watering, mowing, and replanting as necessary for at least thirty (30) days and as much longer as is necessary to establish a uniform stand of the specified grassed, and until acceptance by the Owner.

3.12 INSPECTION

A. Inspections of the work to determine completion of contract work exclusive of possible replacement, will be made by the Engineer after the maintenance period upon written notice requesting such inspection submitted by the Contractor at least 10 days prior to the anticipated date.

B. The condition of lawns will be noted and determination made by the Engineer and Owner as to whether maintenance shall continue in any part.

C. After inspection, the Contractor will be notified in writing by the Engineer of acceptance of seeding work exclusive of the possible replacement.

3.13 GUARANTY AND REPLACEMENT

A. Lawns and planting shall be guaranteed for a maximum of one year after the conclusion of the maintenance period, or for the duration of one full growing season, after planting, whichever is longer, and shall be alive and in satisfactory growth at the end of the guaranty period, subject to normal care as recommended by the Contractor after acceptance of the work.

B. At the end of the guaranty period, inspection will be made by the Engineer and a representative of the Owner upon written notice requesting such inspection submitted by the Contractor at least 10 days before the anticipated date.

C. Any planting required under this contract that is dead or not in satisfactory growth, as determined by the Engineer and Owner's representative, shall be removed from the site. These shall be replaced as soon as conditions permit.

END OF SECTION

SECTION 331113
WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 specifications sections, apply to this section.

1.2 SUMMARY

A. The work of this section consists of:
   1. Furnishing, installing and testing all water lines.
   2. Furnishing and installing Fire Hydrants.

PART 2 PRODUCTS

2.1 MATERIALS

A. PVC pipe shall conform to the latest edition of the AWWA, ASTM, Plastic Pipe Institute, (PPI) or UniBell Plastic Pipe Association standards or recommendations. All PVC pipe shall NSF certified.

1. Pipe sizes between 4 inches and 12 inches shall meet the requirements of AWWA C900 for Class 200 SDR-21.

2. Pipe for sizes 3" and less shall meet the requirements of ASTM D2241 for Class 200 SDR-21.

3. All pipe joints shall be slip joint with neoprene gasket.

B. Fittings shall be Class 350 Ductile Iron Fittings with mechanical joints and shall meet AWWA C153. Mechanical joints shall meet the requirements of AWWA C110.

C. Ductile Iron pipe shall be Class 52 Ductile Iron Cement Mortar Lined Pipe with push-on joints. Pipe shall meet AWWA C151.

D. Fire Hydrant Fire hydrants shall have 5 1/4-inch valve opening, three way, two 2 1/2-inch hose outlet nozzles and one 4 1/2-inch pumper outlet nozzle.

1. Outlet nozzle threads shall be National Standard Threads.

2. Hydrants shall have a National operating nut, 1 1/2-inch pentagon, opening to the left (counterclockwise), 48 inch bury, with 6-inch flanged inlet bottom connection and 6-inch flange by hub-end mechanical joint valve, opening to the left (counterclockwise), non-rising stem with O-ring seal, 2-inch square operating nut.

3. Fire Hydrants will be provided by the following manufacturers: Mueller Company, Inc., American-Darling & Waterous Hydrants or Kupferle Foundary.

PART 3 EXECUTION

3.1 GENERAL

A. Only competent workmen shall be employed on this phase of the work and equipment suitable for the execution of the work shall be utilized.

B. Any incompetent workmen observed by the Engineer must be removed at his request; and where improper equipment or lack of equipment appears to be impairing the quality or speed of their work, adjustment shall be made to the Engineer's satisfaction.

3.2 LAYING CONDITIONS AND INSTALLATION

A. The trench shall be excavated in accordance with the provisions of Section 312333 of the Specifications.

B. The pipe shall be lowered in the trench piece by piece by means of suitable equipment. Under no circumstances shall pipe or other materials be dropped or dumped into the trench.

C. To avoid improperly sized or spaced bell holes impairing the pipe length bearing on the trench bottom, bell holes shall be dug by hand and only far enough ahead that accuracy of their proper location can be assured.

D. They shall be of minimum size, providing ample room that the joint may be properly and efficiently made up. Machine-cut bell holes shall not be permitted.

E. All waterlines shall be installed with a minimum cover of 42 inches.

3.3 DELIVERY OF MATERIALS TO JOB

A. All materials delivered by truck shall be inspected as they are unloaded.

B. Damaged pipe or materials shall not be left at the storage yard or taken to the job site but shall be removed as soon as possible in order that rejected material will not mistakenly be used in construction.

C. All pipe fittings, valves, and other accessories shall be unloaded using hoists or skids and shall be handled in such manner as to avoid damage due to shock.

D. Under no circumstances shall pipe be dropped to the ground from the cars or trucks.

E. Special precaution shall be taken to prevent the rolling of pipe to strike another forcefully.

F. Machine materials, valves, hydrants, etc., shall be handled in such manner as to protect the alignment and finished parts of same.

3.4 ANCHORAGE OF BENDS, TEES AND PLUGS

A. On all pipe lines two (2) inch in diameter and larger, all tees, plugs, caps and bends shall be squarely anchored by suitable thrust concrete backing.

B. Such concrete backing shall be so placed that the pipe or fitting joints will be accessible for repair.

C. The concrete shall meet the requirements for Class B concrete as specified in Section 033000 of the Specifications and shall be placed between solid ground and the fitting to be anchored.

D. The area of the bearing on the pipe and the ground in each instance shall be a minimum of four square feet or as shown on the plans as determined by the Engineer.

E. Mechanical joint restraints, such as a retainer gland or restraint harness may be used in lieu of concrete thrust blocking.

F. Precast concrete blocks shall not be used for blocking.

3.5 TESTING

A. Pressure and Leakage Test of the water line shall be in accordance with AWWA C605 for PVC lines and AWWA C600 for ductile iron pipe lines.

B. The Contractor shall furnish the necessary water, meter, and water piping used in making the test.

C. The use of compressed air for testing pipe will not be permitted.

D. The length of the test shall be a minimum of 2 hours.

E. Allowable leakage shall be in accordance to the following table:

PIPE SIZE	PRESSURE (PSI)	LEAKAGE (GAL. / HR.)	PRESSURE (PSI)	LEAKAGE (GAL. / HR.)	PRESSURE (PSI)	LEAKAGE (GAL. / HR.)
3	100	0.20	150	0.23	200	0.25
4	100	0.27	150	0.30	200	0.33
6	100	0.41	150	0.45	200	0.50
8	100	0.54	150	0.60	200	0.66
12	100	0.81	150	0.91	200	0.99
14	100	0.95	150	1.06	200	1.16
16	100	1.08	150	1.21	200	1.32
18	100	1.22	150	1.36	200	1.49
20	100	1.35	150	1.51	200	1.66
24	100	1.62	150	1.81	200	1.99
30	100	2.03	150	2.27	200	2.48

3.6 FLUSHING AND DISINFECTING COMPLETED LINES:

A. Before placing the line in service, all water mains shall be systematically and thoroughly flushed for removing any remaining dirt or foreign matter.

B. The main shall be filled to eliminate air pockets and shall be flushed to remove particulates.

C. The flushing velocity in the main shall not be less than 2.5 ft/s unless the Engineer or Contractor determines that conditions do not permit the required flow to be discharged to waste.

D. Note that flushing is no substitute for preventive measures during construction. Certain contaminates, such as caked deposits, resist flushing at any feasible velocity.

E. In mains of 24-in. or larger diameter, an acceptable alternative to flushing is to broom- sweep the main, carefully removing all sweepings prior to chlorinating the main.

F. After flushing, the mains shall be disinfected by chlorination to a completely sterile condition to the satisfaction of the Engineer and the Missouri Department of Natural Resources.

G. Chlorination shall be in accordance with AWWA C651, Continuous-Feed Method. The continuous-feed method consists of completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and filling the main with potable water chlorinated so that after the 24 hours holding period in the main there will be a free chlorine residual of not less than 10 mg/L.

H. Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate into the newly laid water main.

I. At a point not more than 10 ft. downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 25 mg/L free chlorine.

J. To assure that this concentration is provided, measure the chlorine concentration at regular intervals in accordance with the procedures described in the current edition of Standard Methods for the Examination of Water or Wastewater or AWWA Manual M12.

K. The following table provides the amount of chlorine required for each 100' length of pipe of various diameters.

L. Solutions of 1% chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires 1 pound of calcium hypochlorite in 8 gallons of water.

PIPE DIA. (IN.)	100% CHLORINE		1% CHLORINE SOLUTION	
4	0.013 LBS.	5.9 GRAMS	0.16 GALLONS	0.6 LITERS
6	0.030 LBS.	13.6 GRAMS	0.36 GALLONS	1.4 LITERS
8	0.054 LBS	24.5 GRAMS	0.65 GALLONS	2.5 LITERS
10	0.085 LBS.	38.6 GRAMS	1.02 GALLONS	3.9 LITERS
12	0.120 LBS.	54.4 GRAMS	1.44 GALLONS	5.4 LITERS
16	0.217 LBS	98.4 GRAMS	2.60 GALLONS	9.8 LITERS

M. During the application of chlorine, valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service.

N. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water.

O. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the treated section shall be operated to ensure disinfection of the appurtenances.

P. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine.

Q. Direct-feed chlorinators, which operate solely from gas pressure in the chlorine cylinder, shall not be used for application of liquid chlorine. (The danger of using direct-feed chlorinators is that water pressure in the main can exceed gas pressure in the chlorine cylinder. This allows a backflow of water into the cylinder, resulting in severe cylinder corrosion and escape of chlorine gas.)

R. The preferred equipment for applying liquid chlorine is a solution-feed, vacuum-operated chlorinator and a booster pump. The vacuum-operated chlorinator mixes the chlorine gas in solution water; the booster pump injects the chlorine-gas solution into the main to be disinfected.

S. Hypochlorite solutions may be applied to the water main with a gasoline or electrically powered chemical-feed pump designed for feeding chlorine solutions.

T. Feed lines shall be of such material and strength as to safely withstand the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps.

U. All connections shall be checked for tightness before the solution is applied to the main.

V. After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with pipe. To prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.

W. The environment to which the chlorinated water is to be discharged shall be inspected. If there is any question that the chlorinated discharge will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water.

X. Where necessary, federal, state, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

3.7 BACTERIOLOGICAL TESTING

A. After final flushing and before the water main is placed in service, a sample or samples shall be collected from the end of the line, shall be tested for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater, and shall show the absence of coliform organisms.

B. At least one sample shall be collected from the new main and one from each branch. In case of extremely long mains, it is desirable that samples be collected along the length of the line as well as at its end.

C. If, during construction, trench water has entered the main, or if in the opinion of the owner's engineer or job superintendent, excessive quantities of dirt or debris have entered the main, bacteriological

samples shall be taken at intervals of approximately 200 ft. and shall be identified by location.

D. Samples shall be taken of water that has stood in the main for at least 16 hours, after final flushing has been completed. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulphate as required by Standard Methods for the Examination of Water and Wastewater.

E. No hose or fire hydrant shall be used in collection of samples.

F. If the initial disinfection fails to produce satisfactory bacteriological samples, the main may be re-flushed and shall be resampled. If check samples show the presence of coliform organisms, then the main shall be re-chlorinated until satisfactory results are obtained.

3.8 PRIVATE RIGHTS-OF-WAY AND CLEAN-UP

A. Driveways, sidewalks, culverts, fences, and other structures removed or damaged by the Contractor shall be replaced at the Contractor's expense.

B. Repair of such structures shall be made as soon as possible after the line has been laid.

C. Care will be taken to safeguard the property, crops, and livestock of the individual landowners involved.

3.9 SEPARATION OF WATER AND SEWER LINES:

A. Whenever possible, all water mains shall be at least 10 feet, horizontally, from any sanitary sewer, storm sewer, or manhole.

B. When local conditions prevent a lateral separation of 10 feet, a water main may be closer than 10 feet to a sanitary or storm sewer, provided that the water main is in a separate trench, or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

C. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and sewer must be constructed of mechanical or slip-on joint ductile iron pipe, or prestressed concrete cylinder pipe, and should be pressure-tested to assure water-tightness before backfilling.

D. Whenever water mains must cross sanitary sewers, house sewers, or storm drains, the water main shall be at such an elevation that the bottom of the water main is 18 inches above the top of the drain or sewer.

E. A full length of water main pipe shall be centered over the sewer line to be crossed so that the joints will be equally distant from the sewer and as remote therefrom as possible.

F. This vertical separation shall be maintained for that portion of the water main located within 10 feet, horizontally, or any sewer or drain it crosses.

G. Where conditions prevent the minimum vertical separation set forth above from being maintained,

or when it is necessary for the water main to pass under a sewer or drain, the water main shall be laid with slip-on or mechanical joint ductile iron pipe, or prestressed concrete cylinder pipe, and the water main shall extend on each side of the crossing to a distance from the sewer of at least 10 feet.

H. In making such a crossing, a full length of water main pipe must be centered over or under the sewer to be crossed, so that the joints will be equidistant from the sewer and as remote therefrom as possible.

I. The sewer line must also be constructed of ductile iron pipe with slip-on or mechanical joints until the normal distance from the sewer line to the water main is at least 10 feet.

J. Where a water main must cross under a sewer, a vertical separation of 18 inches between the bottom of the sewer and the top of the water main shall be maintained, with adequate support, especially for the larger sized sewer lines to prevent them from settling on and breaking the water main.

K. The sewer shall be constructed of ductile iron pipe for 10 feet on either side of the crossing, or other suitable protection as approved by the Department of Natural Resources shall be provided.

L. Where these conditions cannot be met, the Department of Natural Resources shall be consulted as to the precautions to be taken to protect the public water supply.

M. No water pipe shall pass through or contact any part of a sewer or a sewer manhole.

3.10 DETECTOR WIRE AND WARNING TAPE

A. The Contractor shall lay a #10 gage copper wire along with the water main and service line to aid in locating the line after backfilling.

B. A plastic warning tape shall also be laid a minimum of 12 inches above the water line.

END OF SECTION

SECTION 333113
GRAVITY SEWER LINE

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.

1.1 SUMMARY

A. The work shall consist of:

1. Installation of all gravity sanitary sewer pipe.

PART 2 PRODUCTS

2.1 MATERIAL

A. PVC pipe and fittings shall meet or exceed the requirements of ASTM D3034, shall be SDR 35 or heavier, and shall have gasketed joints.

PART 3 EXECUTION

3.1 LAYING SEWER PIPE

A. Pipe shall be laid using a laser beam or a grade rod that has an iron heel for the invert and notches for the grade line stretched over the sewer.

B. The alignment of all pipe lines between adjacent manholes shall be true to line and grade.

C. The pipe line from manhole to manhole shall reflect the full bore of the pipe. The pipe section shall be truly centered into the adjacent pipe section at each joint.

D. At all pipe joints, the bedding shall be excavated sufficiently so that the pipe bell will not rest on the bedding material but all the weight of the pipe shall be evenly distributed along the entire length of the barrel of the pipe.

E. In laying the pipe, water shall be removed from the trench to an elevation below flow line while the pipe is being laid.

F. No pipe shall be laid on frozen bedding material.

G. Where shown on the drawings, the flow lines are the internal inverts of the sewer pipelines.

H. The pipes and special fittings shall be laid to true line and grade throughout and all junctions, curves, branches and other pieces required shall be properly excavated for and laid as shown on the drawings and as directed by the Engineer.

I. The sewer shall be constructed watertight at all points.

J. Any leaks or other defects discovered at any time shall be immediately repaired, or that portion of the sewer shall be rebuilt, if necessary.

K. In all cases, full length joints of pipe shall be used, except in making closures. The pipe shall not be rolled or dragged across the ground, truck bed, or other length of pipe.

L. No weight should be placed on the pipe joint when the pipe is hauled, handled or stored.

M. Care shall be taken to insure that the joints of the pipe are clean and free of any foreign material, and be made properly using the jointing materials specified.

N. The interior of the pipe shall be kept free of superfluous material during construction and flushed out after completion.

O. At the close of each day's work, or when pipe is not being laid, the end of the pipe shall be stopped to prevent access into the pipe.

P. Any pipe which settles or which is not in-true alignment shall, upon orders from the Engineer, be taken up and relaid by the Contractor without cost to the Owner.

Q. Sewers laid on twenty (20) percent slope or greater shall be anchored securely with concrete anchors or equal. Use minimum 4.0 cubic feet of Type B concrete for each collar.

R. Lay pipe with bell on upper end.

S. The anchors shall be placed on the following spacing:

SLOPE OF SEWER	SPACING
20% - > 35%	36’ Center to Center
35& - > 50%	24’ Center to Center
50% or Greater	16’ Center to Center

T. If restrained joint DSR 21 Class PVC Pipe is used, thrust collars will not be required.

3.2 TESTING OF SEWERS

A. The Contractor will be required to complete air pressure or hydraulic exfiltration tests of all complete line sections and crossings, in the presence of the Engineer, to demonstrate that the lines are free of leaks.

1. Where the top of the sewer is below ground level, a 1/2" galvanized pipe nipple is to be cast into each manhole wall and capped on the inside. The pipe nipple is to be located at the top of the inside bore of the sewer pipe.

2. A test is to be made on each run of sewer line between each two manholes. Tests may be made as each section is completed or may be made after entire line is completed. In any event, satisfactory test results must be obtained before the line or any part thereof will be accepted.

3. All tests are to be conducted in the following manner.

4. Test plugs are to be placed in the end of each sewer pipe on the upstream side of both manholes and inflated to a maximum pressure of 16 psig. Plugs are to be thoroughly blocked to prevent them from blowing out.

5. A clear plastic hose is to be attached to the pipe nipple in the upstream manhole to use as a sight glass and the ground water level recorded. The sewer pipe and upstream manhole are to be filled with water to a level 4-1/2 feet above the ground water level or 7 feet above the pipe invert, whichever is higher.

6. Five minutes shall then be allowed for absorption after which the water level shall be brought to the test elevation. The specified head shall be maintained on the pipe for a period of two hours.

7. Sufficient water shall be added to maintain this level. All water added shall be metered and recorded. The maximum allowable leakage shall be as specified under Section 3.3 INFILTRATION.

8. The Contractor shall provide all water, pumping facilities and metering facilities necessary to perform the tests. After each test all test water is to be pumped out and discharged to the water course.

B. The test shall be performed in accordance with the requirements of ASTM F-1417. The air test shall not be used in conditions where the total air pressure exceeds 9 psig.

1. The total air pressure shall be calculated by adding the test pressure of 4 psig to the equivalent groundwater pressure. The equivalent groundwater pressure shall be calculated as described in Section 3.2.2.1.

2. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected. Pneumatic plugs shall resist internal test procedures without requiring external bracing or blocking.

3. All air used shall pass through a single control panel. Three individual hoses shall be used for the following connections:

   a. From control panel to pneumatic plugs for inflation.

   b. From control panel to sealed line for introducing the low pressure air.

   c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

4. All pneumatic plugs shall be seal-tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked.

5. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

6. In areas where ground water is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately 10" long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed.

7. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.

8. After the manhole to manhole reach of pipe has been backfilled and cleaned and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole inflated and properly braced and restrained.

9. Low pressure air shall be introduced into this sealed line until the internal air pressure reached 4 psig greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

10. The rate of air loss shall be determined by the Time-Pressure Drop Method (1 Psig Pressure Loss). Air shall be added until the pressure in the line is raised to 4 psig and the pipe stabilized as described above.

11. Disconnect the air supply decease the pressure to 3.5 psig before running the test. Determine the time required for the pressure to drop from 3.5 psig to 2.5 psig and compare this interval to the required time and determine if the rate of air loss is within the allowable.

Minimum Specified Time for 1.0 PSIG Pressure Drop For Size and Length of Pipe Indicated (min:sec)								
Dia.	100 feet	150 feet	200 feet	250 feet	300 feet	350 feet	400 feet	450 feet
4"	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6"	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8"	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10"	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12"	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15"	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18"	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21"	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24"	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27"	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30"	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15

12. If the installation fails to meet these requirements, the Contractor shall, at his own expense, determine the source of leakage. He shall then repair or replace all defective materials and/or workmanship.

C. The pipe shall be tested for excessive deflection using a rigid mandrel which shall have a diameter of 95% of the inside diameter of the pipe to be tested.

1. No mechanical pulling devices shall be used.

2. All pipe failing this test will be removed and replace. The test must be conducted at least 30 days after the trench has been backfilled over the pipe.

3.3 INFILTRATION

A. Materials used for sewer joints shall have satisfactory records for preventing infiltration and the entrance of roots.

B. Leakage outward (with the trench dry) or infiltration in the case of wet trenches shall not be permitted to exceed 200 gallons per inch of pipe diameter per mile per day for any section of the system.

3.4 SEPARATION OF WATER AND SEWER LINES:

A. Whenever possible, all water mains shall be at least 10 feet, horizontally, from any sanitary sewer, storm sewer, or manhole.

B. When local conditions prevent a lateral separation of 10 feet, a water main may be closer than 10 feet to a sanitary or storm sewer, provided that the water main is in a separate trench, or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

C. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and sewer must be constructed of mechanical or slip-on joint ductile iron pipe, or prestressed concrete cylinder pipe, and should be pressure-tested to assure water-tightness before backfilling.

D. Whenever water mains must cross sanitary sewers, house sewers, or storm drains, the water main shall be at such an elevation that the bottom of the water main is 18 inches above the top of the drain or sewer.

E. A full length of water main pipe shall be centered over the sewer line to be crossed so that the joints will be equally distant from the sewer and as remote therefrom as possible.

F. This vertical separation shall be maintained for that portion of the water main located within 10 feet, horizontally, or any sewer or drain it crosses.

G. Where conditions prevent the minimum vertical separation set forth above from being maintained, or when it is necessary for the water main to pass under a sewer or drain, the water main shall be laid with slip-on or mechanical joint ductile iron pipe, or prestressed concrete cylinder pipe, and the water main shall extend on each side of the crossing to a distance from the sewer of at least 10 feet.

H. In making such a crossing, a full length of water main pipe must be centered over or under the sewer to be crossed, so that the joints will be equi-distant from the sewer and as remote therefrom as possible.

I. The sewer line must also be constructed of ductile iron pipe with slip-on or mechanical joints until the normal distance from the sewer line to the water main is at least 10 feet.

J. Where a water main must cross under a sewer, a vertical separation of 18 inches between the bottom of the sewer and the top of the water main shall be maintained, with adequate support, especially for the larger sized sewer lines to prevent them from settling on and breaking the water main.

K. The sewer shall be constructed of ductile iron pipe for a distance of 10 feet on either side of the crossing, or other suitable protection as approved by the Department of Natural Resources shall be provided.

L. Where these conditions cannot be met, the Department of Natural Resources shall be consulted as to the precautions to be taken to protect the public water supply.

M. No water pipe shall pass through, or come into contact with, any part of a sewer or a sewer manhole.

3.5 CONNECTION TO EXISTING MANHOLES

A. The Contractor shall complete connections to existing manholes using elastomeric gasket seal.

B. The gasket seals shall be installed in accordance to the manufacturer's recommendations.

C. Grout used in the connections shall be a non-shrink grout.

3.6 SANITARY SEWER SERVICE CONNECTIONS

A. The service connections shall be installed in accordance with the detail shown on the drawings.

B. Service connections shall be provided for each lot in a location determined by the Owner.

C. Where no location has been provided by the Owner, the Contractor shall install the service location near the lowest point on the lot at a location five feet inside the property line.

D. The Contractor shall install a service riser pipe when the sewer line tee connection is greater than six feet in depth.

E. The riser pipe shall extend to within five feet of the existing ground surface and shall be plugged and sealed.

F. Where the sewer main is located within a street right-of-way, the Contractor shall extend the service connection to a point five feet inside the property line of the lot to be served.

G. Where service connections are required to be extended across existing streets or roads to the lot to be served, the trench shall be backfilled with granular backfill material and the street cut repaired in accordance with Section 312333 of the Specifications.

3.7 DETECTOR WIRE AND WARNING TAPE

A. The Contractor shall lay a #10 gage copper wire along with the sanitary sewer service line to aid in locating the line after backfilling.

B. A plastic warning tape shall also be laid a minimum of 12 inches above the service line.

END OF SECTION

SECTION 334113
DRAINAGE PIPE AND CULVERTS

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.

1.1 SUMMARY

A. This section includes the

1. Furnishing and installation of all storm sewer and entrance pipe.

PART 2 PRODUCTS

2.1 MATERIALS

A. Reinforced concrete pipe shall be designed and manufactured to meet ASTM C76, latest revision for Class III pipe with Wall B thickness.

1. Certification of pipe shall include assurance that absorption does not exceed six (6) percent when tested per ASTM C497, latest revisions.

2. Pipe shall be provided with joints designed to conform to ASTM C443, latest revision.

3. Flexible gaskets shall be circular cross section, confined O-Ring gaskets, conforming to ASTM C443, latest revision. Gasket shall serve as sole means of sealing the joint.

B. High Density Polyethylene pipe shall meet the requirements of AASHTO M294.

1. The pipe and fittings shall be made from virgin PE compounds which conform to the requirements ASTM D3350.

2. The pipe shall have a full circular cross-section with an outer corrugated pipe wall and an essentially smooth inner wall.

3. The corrugations may be either spiral or annular.

4. The fittings shall not reduce or impair the overall integrity or function of the pipe line and may be molded or fabricated.

5. The fittings may be installed by various methods such as snap-on, screw-on, bell and spigot, and wrap around.

6. Couplings shall provide sufficient longitudinal strength to preserve pipe alignment and prevent separation at the joints.

7. Only fittings supplied or recommended by the pipe manufacturer shall be used.

PART 3 EXECUTION

3.1 LAYING STORM SEWER PIPE AND ENTRANCE PIPE

A. Pipe shall be laid using a laser beam or a grade rod that has an iron heel for the invert and notches for the grade line stretched over the sewer.

B. The alignment of all pipe lines shall be true to line and grade.

C. The pipe line shall reflect the full bore of the pipe.

D. The pipe section shall be truly centered into the adjacent pipe section at each joint and at all pipe joints, the bedding shall be excavated sufficiently so that the pipe bell will not rest on the bedding material but all the weight of the pipe shall be evenly distributed along the entire length of the barrel of the pipe.

E. Where shown on the drawings the flow lines shown are the internal inverts of the pipe.

F. The pipes and special fittings shall be laid to true line and grade throughout and all junctions, curves, branches, and other pieces required shall be properly excavated for and laid as shown on the drawings.

G. The sewer shall be constructed watertight at all points.

H. Any leaks or other defects discovered at any time shall be immediately repaired, or that portion of the sewer shall be rebuilt, if necessary.

I. In all cases, full length joints of pipe shall be used, except in making closures.

J. In laying the pipe, water shall be removed from the trench to an elevation below flow line while the pipe is being laid.

K. No pipe shall be laid on frozen bedding materials.

L. The pipe shall not be rolled or dragged across the ground, truck bed, or other length of pipe.

M. No weight should be placed on the pipe joint when the pipe is hauled, handled or stored.

N. Care shall be taken to insure that the joints of the pipe are clean and free of any foreign material, and be made properly using the jointing materials specified.

O. The interior of the pipe shall be kept free of superfluous material during construction and flushed out after completion.

P. At the close of each day's work, or when pipe is not being laid, the end of the pipe shall be stopped to prevent access into the pipe.

Q. Any pipe which settles or which is not in true alignment shall, be taken up and relaid by the Contractor without cost to the Owner.

3.2 INFILTRATION

A. Materials used for pipe joints shall have satisfactory records for preventing infiltration and the entrance of roots.

B. Leakage or infiltration in the case of wet trenches shall not be permitted to exceed 200 gallons per inch of pipe diameter per mile per day for any section of the system as determined by flow measurement in the pipe.

3.3 TESTING

A. Hydrostatic testing will not be required.

B. However; the Contractor shall use materials as specified herein and use good construction methods and workmanship for an in-place storm sewer that functions as intended.

3.4 SUBMITTALS

A. The Contractor shall provide the Engineer six (6) copies of Letters of Certification from the manufacturer of pipe, fittings, gaskets, and incidental elements of material certifying that materials provided were manufactured in accordance with prevailing specifications and that all materials and manufacturing provided will meet or exceed standards of quality set forth in these specifications.

END OF SECTION

Appendix A
Geotechnical Report

GEOTECHNICAL ENGINEERING REPORT
CAMP CROWDER
MISSOURI NATIONAL GUARD FACILITY
NEOSHO, MISSOURI

Prepared For:

GLMV Architecture Inc.
Kansas City, Missouri

February 13, 2019
Olsson Project No. 018-3101

olsson

February 13, 2019

GLMV Architecture Inc.
Attn: Mr. Ryan Kremer
9229 Ward Parkway, Suite 210
Kansas City, Missouri 64114

Re: Geotechnical Engineering Report
Camp Crowder Missouri National Guard Facility
Neosho, Missouri
Olsson Project No. 018-3101

Dear Mr. Kremer,

Olsson has completed the geotechnical engineering report for the above referenced project. This report summarizes our understanding of the project, presents the findings of the borings and laboratory tests, discusses the observed subsurface conditions, and based on those conditions, provides our opinion and geotechnical engineering recommendations for this project.

We appreciate the opportunity to provide our geotechnical engineering services for this project. If you have any questions or need further assistance, please contact us at your convenience.

Respectfully submitted,
Olsson, Inc.

Suchan Lamichhane, Ph.D., P.E.
Geotechnical Engineer

James M. Landrum, P.E.
Senior Engineer

STATE OF MISSOURI
JAMES M. LANDRUM
NUMBER
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2/13/19

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A. PROJECT UNDERSTANDING

A.1. GEOTECHNICAL SCOPE

This Geotechnical Engineering Report presents the results of the subsurface exploration completed for the proposed 30-man and 60-man barracks, fitness center, dining building, and administration/headquarters building at Camp Crowder in Neosho, Missouri. Twenty-five (25) borings were drilled at the site for the new structures and associated pavement areas. Based on the subsurface conditions encountered in the borings, this Geotechnical Report presents our recommendations and opinions for the support of foundations, floor slabs and pavements associated with the proposed buildings.

A.2. SITE INFORMATION

The project site is located within the Camp Crowder Missouri Nation Guard Facility in Neosho, Missouri. The proposed buildings are located as shown in Figure A.1. At the time of our exploration, most of the building sites were vacant tracts covered with native shrubs and weeds except for two building sites, which were covered with an aggregate surface.

Based on our review of readily available historical aerial images obtained from Google Earth dating back to 1997, the individual project sites for the buildings have been essentially unchanged; however, many of the surrounding buildings were built since 1997. The two aggregate surface pads were also constructed sometime between 1997 and 2003.

Figure A.1: Site Location

A.3. PROJECT INFORMATION

We understand the following five buildings will be located as shown in Figure A.1:

- Administrative / Headquarters Building
- 200 Man Dining Building
- Fitness Center
- 30 Man Barracks
- 60 Man Barracks

Maximum column and wall loads for these structures are assumed to be 60 kips and 4 kips per lineal foot or less. One at-grade parking lot is planned south of the 200 Man Dining Building and another is planned north of the 30 Man Barracks.

We anticipate each building pad and parking area will be graded to achieve a relatively flat surface. We expect the site grading to consist of minimal cuts and fills of less than two feet.

The geotechnical recommendations presented herein are based on the available project information, proposed project location, and the subsurface conditions described in this report. If the loads or any of the noted information is incorrect, please inform ***Olsson*** so that we may amend the recommendations presented in this report if appropriate.

B. EXPLORATORY AND TEST PROCEDURES

B.1. FIELD EXPLORATION

Twenty-five (25) borings were drilled across the project site to approximate depths ranging from 5 to 15 feet with a truck-mounted drill-rig using solid-stem, continuous flight augers. Five borings were drilled within the parking areas (borings PK-1 to PK-5) to approximate depths of 5 feet each. Four borings were drilled to an approximate depth of 15 feet within the footprint of each building:

- Administrative / Headquarters Building – borings HQ-6 to HQ-9
- 200 Man Dining Building – borings D-10 to D-13
- 60 Man Barracks – borings B-14 to B-17
- Fitness Center – borings F-18 to F-21
- 30 Man Barracks – borings B-22 to B-25

The general locations of the borings were selected by ***Olsson*** based on the proposed site layout. The boring locations were determined by ***Olsson's*** Survey Crew. Approximate locations of the borings are shown on the Boring Location Plan in Appendix A and the Boring Logs are provided in Appendix B.

Soil samples were obtained at selected intervals in the borings using a split spoon sampler during the Standard Penetration Tests (SPT; "SS" on the boring logs). The standard split spoon sampler was driven in three 6-inch intervals into the substrata with blows from a 140-pound automatic hammer free-falling 30 inches. Penetration resistance (blow counts) were recorded for each 6-inch drive. Penetration resistance of the final 12 inches is considered SPT "N" values for the SS sampler. The blow counts and SPT "N" values are shown on the boring logs at the respective depths the samples were taken. The sample were sealed and transported to our laboratory for testing and classification.

B.2. LABORATORY TESTING

At our laboratory, all recovered soil samples were visually classified using the Unified Soil Classification System (USCS). The moisture contents of all samples were measured. In addition, Atterberg limits tests were performed on three selected samples. The field logs that were prepared by the drill crew were modified based on our observations of the samples and the results of the laboratory tests. Copies of the final boring logs are provided in Appendix B. The laboratory test results are presented on the respective boring logs and in the laboratory test result graphs in Appendix C.

C. SUBSURFACE CONDITIONS

C.1. SOIL STRATIGRAPHY

The appended boring logs show soil and bedrock conditions at the boring locations at the time they were drilled. The stratification boundaries shown on the boring logs represent the approximate locations of changes in the soil and bedrock types. In-situ, this transition is usually gradual. The boring logs do not reflect variations that may occur between borings or across the project site. The nature and extent of such variations may not become evident until construction.

Beneath the surficial materials, the subsurface conditions encountered in the borings consisted of clay soils with varying amounts of chert. Existing fill was encountered in several borings to depths of up to 6 feet. It is possible that the fill could be deeper in other areas across the site. Thin layers of chert, typically 1 foot or less, were encountered in borings HQ-8, F-19, F-20, B-22, and B-23 at varying depths. Weathered limestone or, possibly, a chert seam, was encountered in boring D-11 at an approximate depth of 14 feet. This boring terminated in the apparent limestone at a depth of 15 feet. The remaining borings terminated in clay soils at depths of 5 feet (parking lot borings) to 15 feet (building borings).

C.2. GROUNDWATER OBSERVATION

At borings PK-1 and PK-2, water was observed while drilling at a depth of 4 feet. Water was not observed in any of the other borings either during drilling or immediately upon completion. Variations and uncertainties exist with relatively short-term water level observations that were recorded during this exploration. Water levels can and should be anticipated to vary between boring locations, as well as with time within a specific boring. Water also tends to be present near the soil and bedrock interface and can flow through joints in the bedrock. Groundwater levels may be expected to fluctuate with precipitation, site grading, drainage and adjacent land use. Long term monitoring with piezometers generally provides a more representative indication of the potential range of groundwater conditions.

D. GEOTECHNICAL CONSIDERATIONS

D.1 KARSTIC FEATURES

To help evaluate the geologic hazards at this site, we reviewed information gathered from the Center for Applied Research and Environmental Systems (CARES) website. The CARES website has information related to current and past mines, mapped sinkholes, known faults and karst prone areas. According to the CARES website, this site is located within the Meramecian Series geologic unit that contains carbonate rocks such as limestone at or near the land surface in a humid climate, but is outside of karst prone soil zones as shown in Figure D.1. Fault lines are also shown in Figure D.1 with the closest fault approximately 6 miles from the project site.

Carbonate rocks are a potential geologic hazard, since these rocks may dissolve in water resulting in voids and cavities within the rock. When these cavities collapse, sinkholes can form at the ground surface. The nearest mapped sinkhole to this site is located approximately 4 miles of the project site as shown in Figure D.1. While carbonate rocks were not encountered in many of the borings, a layer of weathered limestone was encountered in borings PK-3 and D-11 at varying depths suggesting the presence of rock pinnacles as shown in Figure D.2. Pinnacles are columns or cones of limestone left by dissolution of the surrounding rock.

Figure D.1: Karst, Sinkhole, and Fault Map from CARES Website

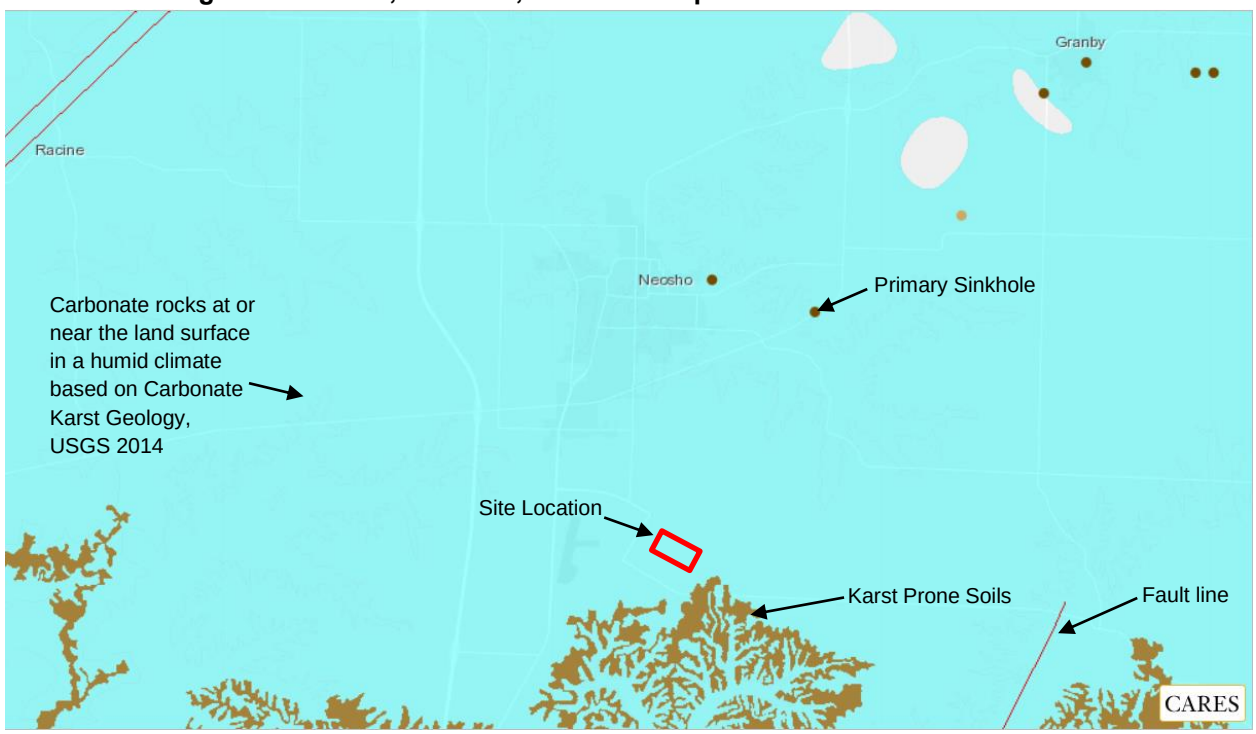
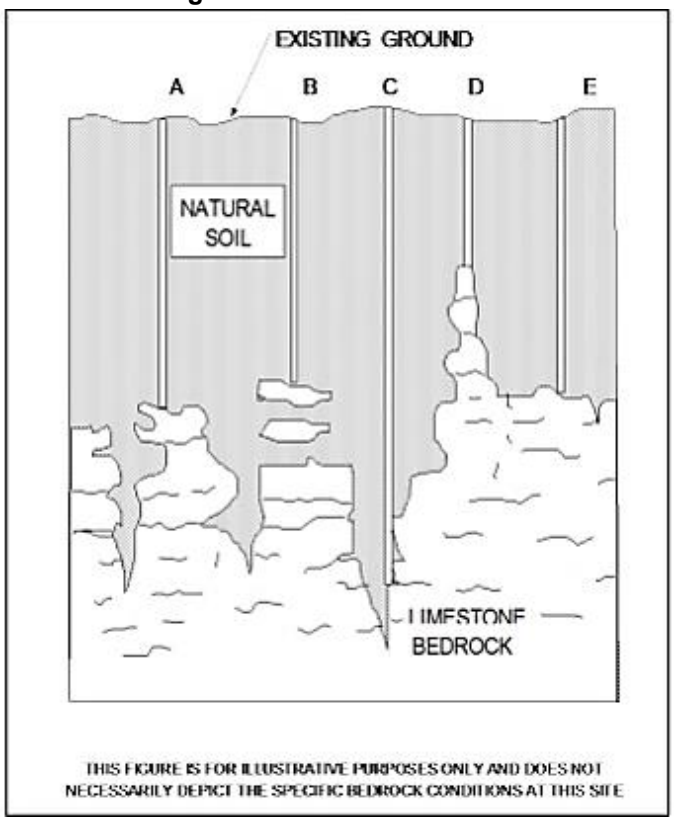


Figure D.2: Rock Pinnacles



D.2 EXISTING FILL

Up to 4 feet of potential fill material was observed at our borings. As the widely spaced, small diameter borings provide only a limited amount of data regarding the extent and composition of the existing fill, the existing fill may contain soft zones, debris or significantly greater amounts of unsuitable materials than could be reasonably inferred from the boring information. In addition, the lateral extent and depth of the fill could be greater that inferred by the boring logs. Test pits could be excavated prior to construction to further evaluate the extent and composition of the existing fill. Records regarding past fill placement on the site could also be reviewed, if available.

Based on the borings, the existing fill did not appear to have been placed with strict moisture, density, and material control necessary for the support of future structures. Foundations, floor slabs, and pavements supported on the existing fills that have not been compacted under controlled conditions may not perform predictably and could experience unacceptable amounts of total and differential settlement, including voiding beneath floor slabs. The settlement, in turn, could lead to cracking within walls and grade supported floor slabs, depressions and cracking in parking and drive areas, misaligned doors and windows, and other related issues. We recommend that unsuitable existing fill material be entirely removed from the building footprint and parking lot areas, as well as any other settlement sensitive areas, and replaced with structural fill. The zone of fill removal should extend laterally at least five feet beyond the edges of the proposed building footprint and three feet beyond the edges of new pavement areas.

E. SITE PREPARATION

E.1. GENERAL SITE AND SUBGRADE PREPARATION

Prior to commencement of grading operations, any existing organic topsoil, vegetation and related major root systems, organic soils, and any loose, soft or otherwise unsuitable or deleterious material should be stripped and removed from the entire construction area. This removal should also include unsuitable existing fill. Stripping depths and fill thicknesses will likely vary and should be adjusted as necessary. We recommend that the project budget allow for a contingency for removal of unsuitable fill. Site clearing, grubbing, and stripping should be completed during periods of dry weather. Operating heavy equipment on the site during periods of wet weather could result in excessive pumping and rutting of the subgrade soils. These stripped materials should be carefully separated to avoid incorporation into structural fill.

After grubbing, stripping, rough grading, and any required excavations, but prior to any fill being placed, we recommend that the exposed soil subgrades be proofrolled with a loaded tandem axle dump truck weighing at least 20 tons, or similar equipment, where access is feasible. Proofrolling operations should be observed by a representative of ***Olsson***. Once proofrolling is complete, but prior to the placement of fill, the upper 8 inches of exposed surface should be scarified, moisture conditioned, and recompacted to a minimum of 95 percent of maximum dry density as determined by Standard Proctor (ASTM D-698) at a moisture content between optimum and 4 percent above optimum. Once the subgrade has been compacted, the excavated areas should be filled in accordance with the recommendations presented in this report.

E.2. STRUCTURAL FILL

All structural fill and backfill should consist of approved materials, free of debris, organics (organic content less than 5 percent), and other unsuitable materials and should not have any particles larger than 3 inches. The on-site clay soils would be acceptable for use as structural fill except within the recommended low volume change (LVC) zone below the floor slab. Imported fill soils should generally exhibit a liquid limit less than 60 and a plasticity index less than 30 or soils with a minimum chert content of 35 percent contained on the No. 4 sieve. Samples of all proposed fill materials should be submitted to the geotechnical engineer of record prior to use on the site. Laboratory Proctor compaction tests and classification tests should be performed on any fill material placed during mass grading operations.

To reduce the potential for swelling of the subgrade soils and to provide a stable base for the floor slab, material placed within a minimum of 18 inches of the base of the floor slab granular leveling course for the building pad should consist of LVC material having a liquid limit less than 50 percent and a plasticity index less than 25 or a well graded granular material such as MoDOT Type 5 baserock.

We recommend that structural fill and backfill be compacted in accordance with the criteria provided in Table E.1. An ***Olsson*** representative should observe fill placement operations and perform field density tests concurrently to indicate if the specified compaction is being achieved.

Table E.1: Fill Placement Guidelines

Areas of Fill Placement	Material	Minimum Compaction Recommendation*	Moisture Content (% of Optimum)
Granular Layer – 4" beneath floor slab	ASTM C-33, #57 Stone	65% of Relative Density	As necessary to obtain density
Low Volume Change (LVC) – 18" below the based of granular layer in floor slabs	LL < 50 PI < 25	95%	0 to +4 percent
	MoDOT Type 5 Baserock	95%	As necessary to obtain density
Structural Fill – on-site	On-site Cherty Clay Soils	95%	0 to +4 percent
Structural Fill – imported	LL < 60 PI < 30	95%	0 to +4 percent
	Min 35% Chert Retained on No. 4 Sieve		
Pavement Subgrade – 12" below the base of the pavement or aggregate base	LL < 50 PI < 25	95%	0 to +4 percent
	Min 35% Chert Retained on No. 4 Sieve		
Aggregate base for pavement	MoDOT Type 5 Baserock	95%	As necessary to obtain density

*According to ASTM D-698 – Standard Proctor

Suitable fill materials should be placed in thin loose lifts of 8 inches or less. Within small excavations, such as in utility trenches, around manholes, or behind retaining walls, the use of vibrating plate compactors, jumping jack compactors or walk behind sheepsfoot compactors may be used to facilitate compaction in these areas. Loose lift thicknesses of 4 inches or less are recommended where small compaction equipment is used.

The moisture content for the structural fill and backfill at the time of compaction should generally be maintained between the ranges specified above. More stringent moisture limits may be necessary with certain soils and some adjustments to moisture contents may be necessary to achieve compaction in accordance with project specifications.

E.3. Drainage and Groundwater Considerations

Water should not be allowed to collect at the ground surfaces near foundations, floor slabs, or areas of new pavements, either during or after construction. Provisions should be made to quickly remove accumulating seepage water or storm water runoff from excavations. Undercut or excavated areas should be sloped toward one corner to allow rainwater or surface runoff to be quickly collected and gravity drained or pumped from construction areas. Subgrade soils that are exposed to precipitation or runoff should be evaluated by ***Olsson*** prior to the placement of new fill, reinforcing steel, or concrete, to determine if corrective action is required.

To minimize concerns related to improper or inadequate drainage away from foundation bearing subgrades or from cohesive backfill materials used in utility or foundation trenches, we recommend the following:

- Site grading should provide for efficient drainage of rainfall or surface runoff away from new structures and pavement.
- Roof run-off should be collected and discharged directly to the storm sewer system or directed to a location with positive and rapid drainage away from new structures and pavements.
- External hose connections in unpaved areas should incorporate splash blocks to prevent accidental flooding of foundation bearing or backfill soils. External hose connections should have cut-off valves inside the building to prevent accidental or unauthorized use.
- Maintenance personnel should be informed of the potential problems associated with watering near the building.

F. BUILDING AND STRUCTURES

F.1. FOUNDATION DESIGN

In our opinion, shallow foundations bearing on stiff native clay soils or structural fill can be used to support the new buildings. Shallow foundations supported on stiff native clay soils or structural fill can be designed and proportioned for a maximum net allowable net bearing pressure of 2,500 pounds per square foot (psf). The net allowable bearing pressure is the pressure at foundation level in excess of the surrounding overburden pressure. The net allowable bearing capacity can be increased by 1/3 for transient loadings (short term loading such as wind load or seismic load) when used with the alternative basic load combinations of Section 1605.3.2 of IBC 2015.

Perimeter/exterior footings and footings in unheated areas should bear at a minimum depth of 24 inches below the lowest adjacent finished grade for protection against frost and moisture fluctuations. Footings should have a minimum width of 24 inches for isolated column footings and 16 inches for continuous/strip footings. Earth formed trench footings shall be at least 12 inches wide and should be designed with sufficient structural reinforcement to span a minimum of 10 feet when acting as a continuous grade beam under the foundation loads.

Lightly loaded interior partition walls (applying less than 0.75 kips per linear foot) may be supported directly on the slab-on-grade floor. Depending on the floor slab design and the specific wall loads, it may be appropriate to increase the floor slab reinforcement or provide a thickened slab cross section below interior walls. For interior walls with loads greater than 0.75 klf, ***Olsson*** recommends that a footing be installed, independent from the floor slab to properly distribute the wall loads to the underlying soils and reduce the potential for floor slab damage.

Foundations designed and constructed as recommended above would be expected to experience total settlements on the order of 1 inch and differential settlements on the order of ½ inch.

Olsson should observe the bearing conditions at all foundations. It is possible that softer soils could be present near the foundation bearing elevation. If the soils are not suitable to support the foundation design bearing pressure, footings should be deepened to suitable soils. After foundation subgrades have been observed and evaluated by an ***Olsson*** representative, concrete should be placed as soon as possible to avoid subjecting the exposed soils to drying, wetting, or freezing conditions. If foundation subgrade soils are subjected to such conditions, the Geotechnical Engineer should be contacted to reevaluate the foundation bearing materials.

F.2. FLOOR SLAB DESIGN AND SUBGRADE PREPARATION

We recommend the soil within the building footprint be undercut to a depth of 22 inches below the base of the floor slab. We recommend 18 inches MoDOT Type 5 baserock, be placed and compacted beneath the floor slab. Above the LVC zone, we recommend a free draining, 4-inch thick granular leveling and drainage course consisting of ASTM C-33 size No. 57 stone, or equivalent, be installed beneath the concrete floor slab for uniform

support and to act as a capillary break. For moisture sensitive floors, an additional vapor retarder may be required per American Concrete Institute (ACI) 360R recommendations.

The soil subgrade in the areas of concrete slab-on-grade support is often disturbed during foundation and superstructure construction. As such, the moisture content of the LVC zone should be checked and reworked as necessary prior to slab construction. Assuming the above recommendations are implemented, a subgrade modulus of 100 pci can be used for design.

The procedures recommended above may not eliminate all future subgrade volume change and resultant floor slab movement. Common construction practice is to tie the slab-on-grade into the foundation elements to limit the impact of differential movement at doorways. Depending on many factors, including the size and shape of the floor area, the location of construction joints in the slab, the rigidity of the slab and foundation connection, and the magnitude of actual movement that occurs, cracks within the floor slab should be anticipated. Leaking utility lines or water allowed to accumulate beneath the slab could lead to significant movements of the slab.

F.3. Seismic Classification

The soil conditions encountered at this site are consistent with the definition of Site Class “D” (Stiff soil profile) as per ASCE-07/10 site class.

G. PAVEMENTS

G.1. PAVEMENT SUBGRADE PREPARATION

Where high plasticity soils are encountered with a chert content less than 35 percent at the proposed finished pavement elevation, such soils should be overexcavated to a minimum depth of 12 inches below the pavement section and replaced with material that has a liquid limit less than 50 and a plasticity index less than 25 or on-site soils with a minimum chert content of 35 percent contained on the No. 4 sieve. The overexcavation backfill should be compacted as recommended in *Section E.2*.

As the time for pavement construction approaches, the pavement subgrades initially prepared early in the project should be carefully evaluated. We recommend that the moisture content and density of the top 8 inches of the subgrade be checked and the pavement subgrades be evaluated by proofrolling within two days prior to commencement of actual paving operations. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. If the material is not in compliance with the required ranges of moisture or density, the subgrade should then be moisture conditioned and recompacted. If any significant event (such as precipitation) occurs after the evaluation, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

On most project sites, the site grading is accomplished relatively early in the construction phase, and controlled fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy construction traffic disrupts the subgrade and many surface irregularities are filled in with loose soils to temporarily improve trafficability. A non-uniform subgrade can result in poor pavement performance and local failures relatively soon after pavements are constructed. If soft areas are identified during the subgrade preparation or if the subgrade soils have been exposed to adverse weather conditions, frost, excessive construction traffic, standing water, or similar conditions, ***Olsson*** should be consulted to determine if corrective action is necessary.

It is important that the subgrade support be relatively uniform, with no abrupt changes in the degree of support. Non-uniform roadway support can occur at the transition from cut to fill areas, or as a result of varying soil moisture contents or soil types, or where improperly placed utility backfill has been placed across or through areas to be paved. Improper subgrade preparation such as inadequate vegetation removal, failure to identify soft or unstable areas, and inadequate or improper compaction can also produce non-uniform subgrade support.

G.2. PAVEMENT DESIGN

Table G.2. summarizes typical pavement sections for full-depth asphaltic concrete (AC), AC with an aggregate base, and Portland cement concrete (PCC) used in light auto parking areas. The sections represent typical minimum thicknesses assuming routine maintenance and no truck traffic. Routine maintenance typically consists of periodic seal coats and possibly one intermediate mill, in addition to regular crack maintenance.

PCC pavements are recommended for trash receptacle pads and approaches, loading/unloading areas, and other areas where heavy wheel loads will be concentrated. Concrete pavements in these areas should have a minimum thickness of 8 inches with a 4-inch leveling and drainage course of clean, crushed rock placed below the pavements. The leveling and drainage course for the PCC pavements should have an appropriate sub-drainage or other connection to a suitable gravity outfall to remove water from the drainage layer. The pavement subgrade should be graded to provide positive drainage below the granular base section. We further recommend that the length of concrete sections be such that no heavy truck wheels are allowed to rest on AC sections during loading/unloading operations.

Table G.2.: Minimum Recommended Pavement Sections

Parking Areas	Drive Areas	Heavy Vehicle Areas*
Full Depth AC: 2” AC Surface 4” AC Base ACC with Granular Base: 2” AC Surface 3” AC Base 6” Compacted MoDOT Type 5 Full Depth PCC: 5” PCC 4” Clean Rock	Full Depth AC: 2” AC Surface 6” AC Base ACC with Granular Base: 2” AC Surface 4” AC Base 6” Compacted MoDOT Type 5 Full Depth PCC: 6” PCC 4” Clean Rock	Full Depth PCC: 8” PCC 4” Clean Rock *Heavy Vehicle Areas Consist of Loading Areas, Trash Receptacle Pads and Approaches, etc.

The performance of pavements will be dependent upon a number of factors, including subgrade conditions at the time of paving, rainwater runoff, and traffic. Rainwater runoff should not be allowed to seep below pavements from adjacent areas. Pavements should be sloped approximately 1/4 inch per foot to provide rapid surface drainage.

Surface drainage around the pavement and proper maintenance are also important to long-term performance. Curbs should be backfilled as soon as possible after construction of the pavement. Backfill should be compacted and should be sloped to prevent water from ponding and infiltrating under the pavement. All pavement joints should be caulked and any cracks should be quickly patched or sealed to prevent moisture from reaching and softening the subgrade.

Construction traffic on the pavements has not been considered in the above noted typical sections. If construction scheduling dictates that the pavements will be subject to traffic by construction equipment/vehicles, increasing the pavement thickness should be considered to include the effects of additional traffic loading. Construction traffic should not be allowed on partially completed pavements as the pavements will not have adequate structural capacity and could be damaged.

H. CONCLUSIONS AND LIMITATIONS

H.1 CONSTRUCTION OBSERVATION AND TESTING

We recommend that all earthwork during construction be monitored by a representative of ***Olsson***, including site preparation, placement of all engineered fill and trench backfill, construction of slabs, pavements and pavement subgrades, and all foundation excavations. The purpose of these services would be to provide ***Olsson*** the opportunity to observe the soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

H.2 LIMITATIONS

The conclusions and recommendations presented in this report are based on the information available regarding the proposed construction, the results obtained from our soil test borings and sampling procedures, the results of the laboratory testing program, and our experience with similar projects. The soil test borings represent a very small statistical sampling of subsurface soils and it is possible that conditions may be encountered during construction that are substantially different from those indicated by the soil test borings. In these instances, adjustments to design and construction may be necessary.

This geotechnical report is based on the site plan and information provided to ***Olsson*** and our understanding of the project as noted in this report. Changes in the location or design of new structures and/or pavements could significantly affect the conclusions and recommendations presented in this geotechnical report. ***Olsson*** should be contacted in the event of such changes to determine if the recommendations of this report remain appropriate for the revised site design.

This report was prepared under the direction and supervision of a Professional Engineer registered in the State of Missouri with the firm of **Olsson, Inc**. The conclusions and recommendations contained herein are based on generally accepted professional geotechnical engineering practices at the time of this report within this geographic area. No other warranty is expressed, intended or made. This report has been prepared for the exclusive use of **GLMV Architecture Inc.** and their authorized representatives for specific application to the proposed project.

Camp Crowder Missouri National Guard Facility

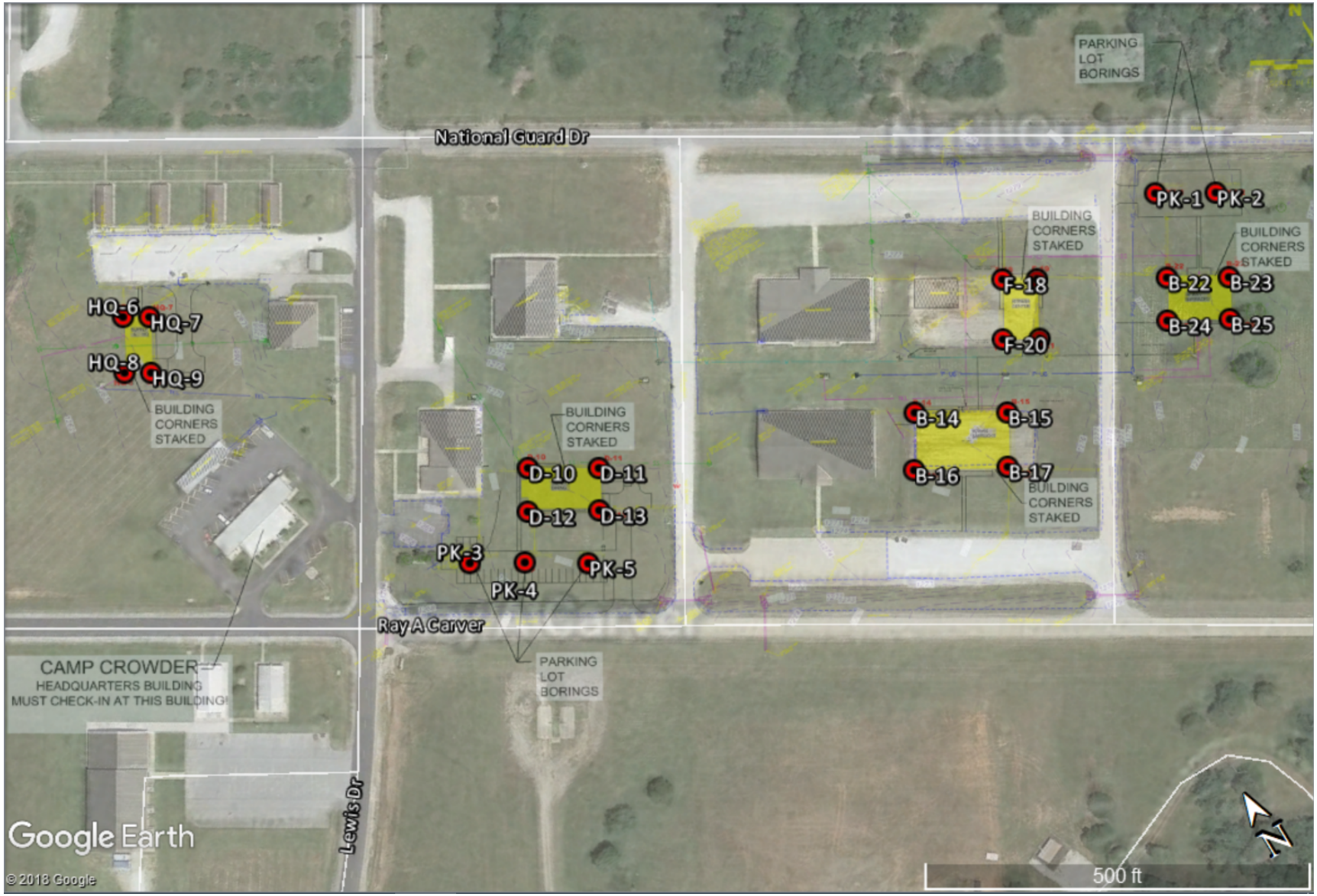
Neosho, Missouri 2019

February 13, 2019

Olsson Project No. 018-3101

APPENDIX A

BORING LOCATION PLAN



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	Boring Location Map
Scale: NTS	**Camp Crowder Missouri National Guard Facility Neosho, Missouri**
Project: 018-3101	
Approved by: JML	
Date: 2/11/2019	

APPENDIX B

SYMBOLS AND NOMENCLATURE
BORING LOGS

SYMBOLS AND NOMENCLATURE

DRILLING NOTES

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon Sample (1.375" ID, 2.0" OD)	HSA:	Hollow Stem Auger	NE:	Not Encountered
U:	Thin-Walled Tube Sample (3.0" OD)	CFA:	Continuous Flight Auger	NP:	Not Performed
CS:	Continuous Sample	HA:	Hand Auger	NA:	Not Applicable
BS:	Bulk Sample	CPT:	Cone Penetration Test	% Rec:	Percent of Recovery
MC:	Modified California Sampler	WB:	Wash Bore	WD:	While Drilling
GB:	Grab Sample	FT:	Fish Tail Bit	IAD:	Immediately After Drilling
SPT:	Standard Penetration Test Blows per 6.0"	RB:	Rock Bit	AD:	After Drilling
				CI:	Cave-In

DRILLING PROCEDURES

Soil samples designated as "U" samples on the boring logs were obtained in using Thin-Walled Tube Sampling techniques. Soil samples designated as "SS" samples were obtained during Penetration Test using a Split-Spoon Barrel sampler. The standard penetration resistance 'N' value is the number of blows of a 140 pound hammer falling 30 inches to drive the Split-Spoon sampler one foot. Soil samples designated as "MC" were obtained in using Thick-Walled, Ring-Lined, Split-Barrel Drive sampling techniques. Recovered samples were sealed in containers, labeled, and protected for transportation to the laboratory for testing.

WATER LEVEL MEASUREMENTS

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In relatively high permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with only short-term observations.

SOIL PROPERTIES & DESCRIPTIONS

Descriptions of the soils encountered in the soil test borings were prepared using Visual-Manual Procedures for Descriptions and Identification of Soils.

PARTICLE SIZE

Boulders	12 in. +	Coarse Sand	4.75mm-2.0mm	Silt	0.075mm-0.005mm
Cobbles	12 in.-3 in.	Medium Sand	2.0mm-0.425mm	Clay	<0.005mm
Gravel	3 in.-4.75mm	Fine Sand	0.425mm-0.075mm		

COHESIVE SOILS

Consistency	Unconfined Compressive Strength (Qu) (tsf)
Very Soft	<0.25
Soft	0.25 – 0.5
Firm	0.5 – 1.0
Stiff	1.0 – 2.0
Very Stiff	2.0 – 4.0
Hard	> 4.0

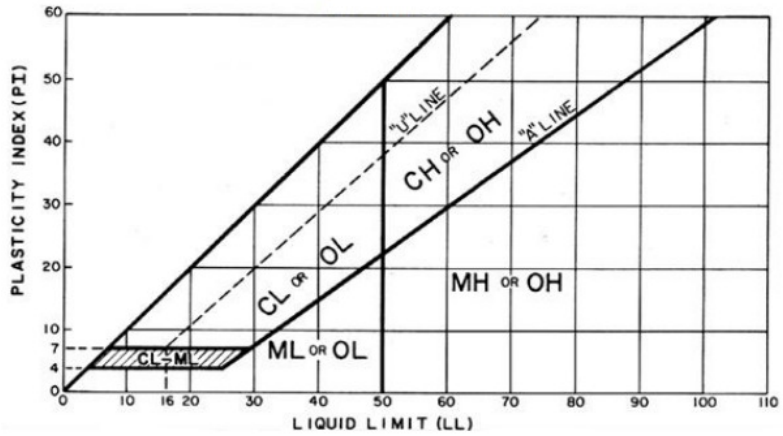
COHESIONLESS SOILS

Relative Density	'N' Value
Very Loose	0 – 3
Loose	4 – 9
Medium Dense	10 – 29
Dense	30 – 49
Very Dense	≥ 50

COMPONENT %

Description	Percent (%)
Trace	<5
Few	5 - 10
Little	15 - 25
Some	30 - 45
Mostly	50 - 100

PLASTICITY CHART



ROCK QUALITY DESIGNATION (RQD)

Description	RQD (%)
Very Poor	0 – 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 – 100

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SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BOREHOLE REPORT NO. B-14

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.3'***		0								
	FILL *Lean to fat clay, dark brown with red brown, silty, with chert*			SS 1		4-3-4 N=7		38.4			
	3.5'										
	FAT CLAY *Reddish brown with brown and gray, cherty*		5	SS 2		5-12-8 N=20		24.8			
	6.2' *Reddish brown, with chert and sand*										
			10	SS 3		17-47-40 N=87		27.1			
	15.0'		15	SS 4		9-9-23 N=32		48.2			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/28/19	FINISHED:	1/28/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. PATTERSON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-15

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	CRUSHED AGGREGATE *1.0'*		0								
	FAT CLAY *Reddish brown, cherty* *3.5'*			SS 1		4-6-10 N=16		20.3			
	Reddish brown with light brown, cherty, sandy		5	SS 2		5-7-23 N=30		36.4			
			10	SS 3		7-10-13 N=23		39.1			
	15.0'		15	SS 4		16-23-12 N=35		38.7			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/28/19	FINISHED:	1/28/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. PATTERSON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-16

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.3'***		0								
	FILL *Dark brown, silty, with chert* ***2.2'***			SS 1		4-4-4 N=8		28.9			
	FAT CLAY *Reddish brown* ***3.5'***										
	Reddish brown, cherty, sandy		5	SS 2		5-14-16 N=30		25.5			
			10	SS 3		5-11-11 N=22		44.1			
	15.0'		15	SS 4		6-13-14 N=27		52.3			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/28/19	FINISHED:	1/28/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. PATTERSON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-17

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY 1.0'										
	Brown with brown gray (possible fill)			SS 1		25-14-8 N=22		25.7			
	FAT CLAY										
	Reddish brown, cherty 3.5'										
	Reddish brown, cherty, sandy		5	SS 2		12-17-18 N=35		23.7			
	8.5'										
			10	SS 3		6-8-22 N=30		34.9			
			15	SS 4		8-8-22 N=30		42.3			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/28/19	FINISHED:	1/28/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. PATTERSON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-22

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Brown with reddish brown*			SS 1	CL	5-12-16 N=28		29.4		41/21	
	FAT CLAY 3.0' *Reddish brown, sandy, cherty*			SS 2		42-31-33 N=64		17.6			
	Reddish brown with light brown, with chert 6.7'		5								
				SS 3		10-26-50/3"		33.9			
			10								
	CHERT 13.8' 14.0'			SS 4		50		40.2			

BASE OF BORING AT 14.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-23

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Dark brown to reddish brown, sandy, cherty, trace gravel (possible fill)* 3.0'			SS 1		6-4-4 N=8		18.8			
	FAT CLAY *Reddish brown with light brown and gray, cherty*		5	SS 2		4-8-8 N=16		25.2			
	9.7'			SS 3		9-5-36 N=41		39.0			
	CHERT 10.5'		10								
	FAT CLAY *Reddish brown, with chert* 13.5'										
	Reddish brown with light brown, trace chert and sand 15.0'		15	SS 4		8-9-10 N=19		45.7			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-24

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	FILL *Dark brown to brown, with organics*			SS 1		4-4-4 N=8		24.9			
	3.2' ***FAT CLAY*** 3.5' *Reddish brown, cherty* *Red to reddish brown, with chert, trace sand*		5	SS 2		14-18-10 N=28		19.4			
			10	SS 3		11-13-12 N=25		45.5			
	15.0'		15	SS 4		12-14-40 N=54		34.0			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-25

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.3'***		0								
	LEAN TO FAT CLAY *Dark brown* ***1.7'***			SS 1	CL	5-3-4 N=7		25.3		42/23	
	Light brown with red brown (possible fill) ***3.0'***										
	FAT CLAY *Red to reddish brown with light brown, with chert*		5	SS 2		23-13-16 N=29		32.7			
			10	SS 3		6-9-30 N=39		44.6			
	15.0'		15	SS 4		8-8-10 N=18		33.3			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. D-10

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Brown to dark brown, trace organics* 2.5'			SS 1		7-7-9 N=16		28.3			
	Reddish brown, cherty, with sand										
			5	SS 2		9-6-9 N=15		36.6			
			10	SS 3		16-17-13 N=30		28.4			
	13.5'										
	Reddish brown to dark red brown, with sand 15.0'		15	SS 4		19-16-32 N=48		45.9			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. D-11

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Dark brown to light gray with reddish brown* 2.2'			SS 1		3-5-14 N=19		25.7			
	FAT CLAY *Reddish brown, with weathered chert* 3.5'										
	Dark reddish brown to red brown, sandy, with chert		5	SS 2		21-12-23 N=35		38.4			
			10	SS 3		12-17-12 N=29		45.2			
	14.2' ***HIGHLY WEATHERED LIMESTONE*** *Yellow brown* 15.0'		15	SS 4		22-19-13 N=32		40.7			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. D-12

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Brown, trace organics* 2.5'			SS 1		5-13-33 N=46		24.6			
	FAT CLAY *Reddish brown with gray, sandy, cherty* 3.5'										
	Reddish brown, sandy, cherty		5	SS 2		15-18-20 N=38		15.5			
	6.0' *Reddish brown, trace chert* 8.5'										
	Dark reddish brown to red brown, with chert and sand		10	SS 3		8-5-8 N=13		43.0			
	15.0'		15	SS 4		12-12-12 N=24		32.8			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. D-13

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Dark brown with gray and red, with gravel and sand* 2.5'			SS 1		5-13-31 N=44		24.7			
	FAT CLAY *Dark reddish brown to red brown, cherty, with sand*		5	SS 2		15-21-16 N=37		26.0			
	8.5'										
	Reddish brown to red, sandy, cherty		10	SS 3		11-18-40 N=58		33.9			
	15.0'		15	SS 4		22-15-12 N=27		48.7			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. F-18

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	CRUSHED AGGREGATE *1.0'*		0								
	FILL *Lean to fat clay, brown, with organics* *3.0'*			SS 1		4-4-3 N=7		37.0			
	FAT CLAY *Gray with reddish brown, silty, with chert* *5.0'*		5	SS 2		44-18-14 N=32		18.1			
	Dark reddish brown to red brown, cherty *10.0'*		10	SS 3		13-13-38 N=51		39.6			
	Reddish brown, sandy, cherty *13.5'*										
	Red brown, with chert *15.0'*		15	SS 4		5-5-17 N=22		49.5			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. F-19

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	FILL		0								
	Lean to fat clay, reddish brown to light brown, cherty			SS 1		6-5-4 N=9		17.5			
	3.2'										
	FAT CLAY ***3.5'***										
	Reddish brown, cherty			SS 2		8-12-13 N=25		18.5			
	Grayish brown with red, with chert		5								
	5.7'										
	CHERT										
	6.5'										
	FAT CLAY										
	Reddish brown, cherty										
	9.1'										
	Red with light reddish brown, sandy, with chert		10	SS 3		6-17-25 N=42		43.4			
			15	SS 4		34-14-7 N=21		50.3			
	15.0'										

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. F-20

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	CRUSHED AGGREGATE ***0.5'***		0								
	FILL *Fat clay, reddish brown, trace chert* ***3.8'***			SS 1		4-3-2 N=5		39.4			
	FAT CLAY *Gray with reddish brown, with sand and chert* ***6.1'***		5	SS 2		4-4-10 N=14		26.1			
	CHERT ***6.6'***										
	FAT CLAY *Reddish brown to light reddish brown, sandy, cherty*		10	SS 3		11-11-30 N=41		42.7			
	15.0'		15	SS 4		11-8-11 N=19		50.1			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. F-21

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.3'***		0								
	FILL *Lean to fat clay, reddish brown to dark brown, with chert*			SS 1		5-5-5 N=10		26.2			
	4.0' ***FAT CLAY*** *Reddish brown with light brown, sandy, cherty*		5	SS 2		7-23-20 N=43		22.3			
			10	SS 3		14-13-33 N=46		31.6			
	13.5' *Red brown, with chert* ***15.0'***		15	SS 4		6-4-4 N=8		47.9			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. HQ-6

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY 1.0'										
	Dark gray brown ***LEAN TO FAT CLAY*** *Reddish brown with yellow brown, sandy, cherty* 3.5'			SS 1		14-24-42 N=66		16.0			
	FAT CLAY *Reddish brown, sandy, cherty*		5	SS 2		8-13-13 N=26		23.9			
			10	SS 3		4-7-7 N=14		38.7			
	15.0'		15	SS 4		28-17-18 N=35		38.1			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. HQ-7

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY 0.9'										
	Dark gray brown			SS 1		17-24-23 N=47		16.2			
	Reddish brown with gray, with gravel and chert, trace silt 2.5'										
	FAT CLAY										
	Red to reddish brown, with chert, trace sand		5	SS 2		16-7-10 N=17		36.0			
	6.5'										
	Red to reddish brown with white, with chert		10	SS 3		6-5-7 N=12		33.4			
	13.5'										
	Red to reddish brown with white, sandy, with chert 15.0'		15	SS 4		11-14-22 N=36		33.1			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. HQ-8

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY 1.0'										
	Brown ***FAT CLAY*** *Reddish brown with gray, sandy, cherty* 3.5'			SS 1		16-41-50/4"		14.4			
	Reddish brown, cherty 5.5'		5	SS 2		6-7-8 N=15		30.9			
	CHERT 6.0'										
	FAT CLAY *Reddish brown, with chert* 8.5'										
	Light reddish brown with white, cherty, with sand 10.0'		10	SS 3		15-11-11 N=22		35.0			
	Brown with red, trace sand and chert 15.0'		15	SS 4		10-10-20 N=30		40.6			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. HQ-9

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY 1.0'										
	Dark brown to light brown ***FAT CLAY***			SS 1		9-28-35 N=63		14.9			
	Reddish brown with gray, sandy, cherty										
			5	SS 2		6-11-14 N=25		28.9			
	8.5'										
	Reddish brown with white, sandy, trace chert		10	SS 3		6-5-6 N=11		35.6			
	13.5'										
	Reddish brown with white, cherty, trace sand 15.0'		15	SS 4		6-11-20 N=31		38.2			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. PK-1

PROJECT NAME **Camp Crowder30 Barracks**	CLIENT **GLMV Architecture Inc**
PROJECT NUMBER **A18-3101**	LOCATION **Joplin, Missouri**

ELEVATION (ft)	MATERIAL DESCRIPTION (Split Spoon)	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.3'***		0								
	FILL *Lean to fat clay, brown, trace organics* ***3.0'***			SS 1		4-6-10 N=16		32.8			
	FAT CLAY *Dark brown with reddish brown, cherty* ***5.0'***		5	SS 2		20-11-10 N=21		24.2			

BASE OF BORING AT 5.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. PK-2

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE	***0.3'***		0								
	FILL											
	Lean to fat clay, brown				SS 1		6-5-7 N=12		30.8			
		3.0'										
	FAT CLAY	***3.5'***										
	Reddish brown				SS 2	CL	5-5-5 N=10		23.1		38/22	
	Reddish brown with light gray brown, trace chert and silt	***5.0'***		5								

BASE OF BORING AT 5.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. PK-3

PROJECT NAME **Camp Crowder30 Barracks**	CLIENT **GLMV Architecture Inc**
PROJECT NUMBER **A18-3101**	LOCATION **Joplin, Missouri**

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
			0								
	ROOT ZONE 0.3'										
	LEAN TO FAT CLAY 1.0'										
	Brown 2.0'			SS 1		11-14-20 N=34		15.2			
	Reddish brown, cherty										
	CHERT 3.5'										
	FAT CLAY										
	Reddish brown, cherty, trace silt 5.0'		5	SS 2		10-33-10 N=43		18.1			

BASE OF BORING AT 5.0 FEET

WATER LEVEL OBSERVATIONS	
WD	4.0 ft
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. PK-4

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
			0								
	ROOT ZONE 0.3'										
	LEAN TO FAT CLAY *Brown, trace organics* 2.0'			SS 1		5-10-34 N=44		27.8			
	Reddish brown 3.5'										
	FAT CLAY *Reddish brown, sandy, with chert* 5.0'		5	SS 2		5-13-12 N=25		35.6			

BASE OF BORING AT 5.0 FEET

WATER LEVEL OBSERVATIONS	
WD	4.0 ft
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. PK-5

PROJECT NAME	CLIENT
Camp Crowder30 Barracks	GLMV Architecture Inc
PROJECT NUMBER	**LOCATION**
A18-3101	Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
			0								
	ROOT ZONE 0.3'										
	LEAN TO FAT CLAY *Brown, trace organics* 2.0'			SS 1		6-10-22 N=32		31.3			
	FAT CLAY *Reddish brown, sandy, cherty*										
	5.0'		5	SS 2		5-12-10 N=22		37.0			

BASE OF BORING AT 5.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

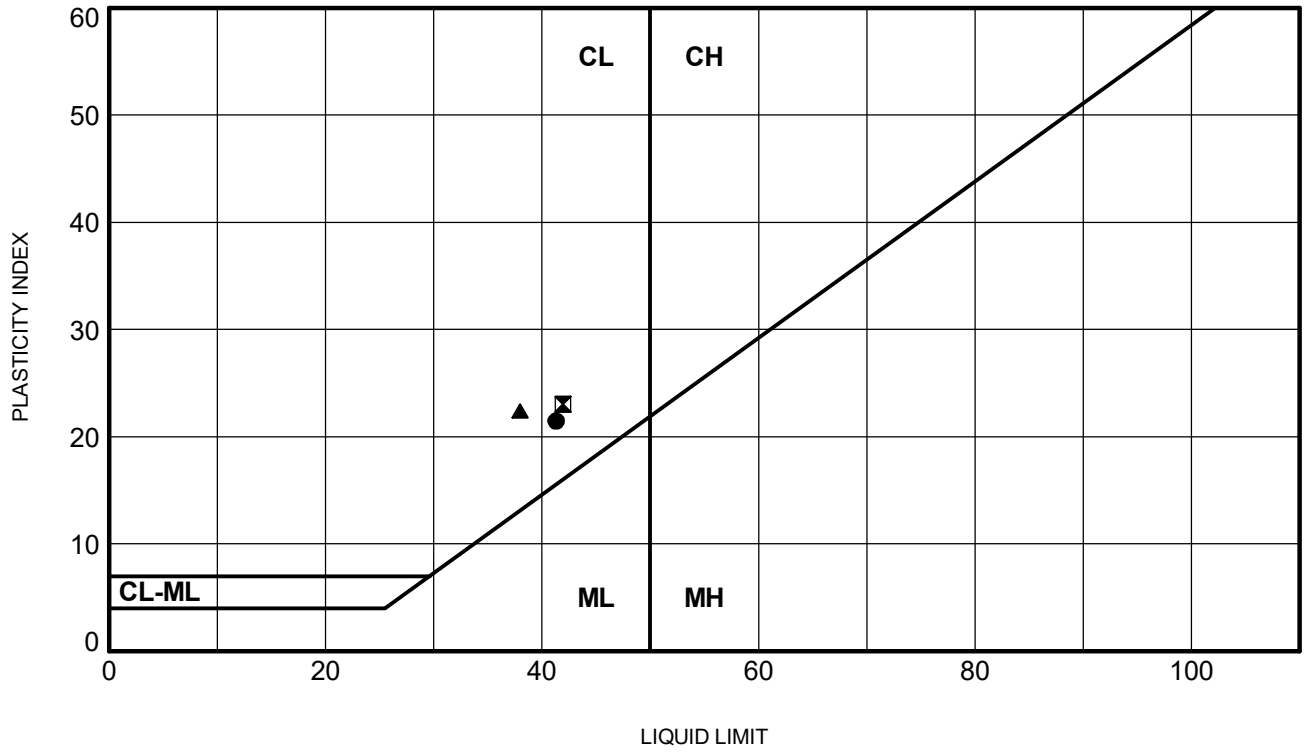
APPENDIX C

SUMMARY OF LABORATORY TEST RESULTS

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

ATTERBERG LIMITS RESULTS

PROJECT NAME: Camp Crowder30 Barracks **CLIENT:** GLMV Architecture Inc
PROJECT NUMBER: A18-3101 **PROJECT LOCATION:** Joplin, Missouri



Boring No.	Sample ID	Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Fines (%)	Classification (USCS)
● B-22	SS-1	1.0 - 2.5	41	20	21		CL
⊠ B-25	SS-1	1.0 - 2.5	42	19	23		CL
▲ PK-2	SS-2	3.5 - 5	38	16	22		CL