PROJECT MANUAL

DINING FACILITY (DFAC) ADDITION
CAMP CLARK BLDG 430
NEVADA, MISSOURI

DESIGNED BY: Olsson
1301 Burlington St,
Kansas City, MO 64116

DATE ISSUED: 7/26/2019

PROJECT NO.: T1716-02

FOR: State of Missouri
Office of Administration
Division of Facilities Management,
Design and Construction
SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

PART 1. GENERAL

1.1 MECHANICAL & ELECTRICAL ENGINEER’S DISCLAIMER OF RESPONSIBILITY

A. I, Cory Wilson, hereby certify that I have coordinated all Plan and Specification Documents. The Plans and Documents authenticated by my Seal are limited to the following:

1) Drawings:
   G000
   G001
   G002
   M101
   E101
   S100
   S101
   S102

2) Specifications:
   All Division #22
   All Division #23
   All Division #26

I hereby disclaim any responsibility for all other Drawings, Specifications, estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of Camp Clark Dining Hall #430 Addition.

By: Cory Wilson
1.2 ARCHITECT’S DISCLAIMER OF RESPONSIBILITY

A. I, Mike McSwain, hereby certify that I have coordinated all Plan and Specification Documents. The Plans and Documents authenticated by my Seal are limited to the following:

1) Drawings:
   - G000
   - A201
   - A202

2) Specifications:
   - All Division #02 thru #14

I hereby disclaim any responsibility for all other Drawings, Specifications, estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of the Camp Clark Dining Hall #430 Addition.

By: Mike McSwain

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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 1 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 APPLICABLE)

PART 3 - EXECUTION

3.1 LIST OF DRAWINGS

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

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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. Dining Facility (DFAC) Addition
Camp Clark Bldg 430
Nevada, Missouri
Project No.: T1716-02

3.0 BIDS WILL BE RECEIVED:

A. Until: 1:30 PM, Thursday, September 5, 2019
B. Place: 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 construction of an outdoor canopy with infrared heaters, handwashing station, and two new insulated cooler/freezers, engineered surrounds, and a roof structure above.
B. Estimate: $251,000 to $345,000
C. MBE/WBE/SDVE Goals: MBE 10.00%, WBE 10.00%, & SDVE 3.00%. NOTE: Only MBE/WBE firms certified by a State of Missouri public entity 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.

5.0 PRE-BID MEETING:

A. Place/Time: 10:00 AM; Friday, August 23, 2019; Camp Clark Training Site, Headquarters Building, 18159 South K Highway, Nevada, MO 64772-9411.
B. Access to State of Missouri property requires presentation of a photo ID by all persons

6.0 HOW TO GET PLANS & SPECIFICATIONS:


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.

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.

Information for upcoming bids is available on the Division’s web site -- http://oa.mo.gov/facilities
Plans, specifications and bidders lists are available on-line for bidders reference on American Document Solutions website – https://www.adsplanroom.net

7.0 POINT OF CONTACT:

A. Designer: Olsson, Cory Wilson, phone # 816-361-1177, fax # 816-361-1888
B. Project Manager: Bill Edwards, phone # 573-638-9534, fax # 573-638-9746

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.

Bid results will be available by the close of business the day following bid opening on the Division of Facilities Management, Design and Construction’s website – https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans
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.

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 - http://oa.mo.gov/facilities/project-management.

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 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 will 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

(NOTE: See Article 7.D below for submittal restrictions.)

**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.** Bids from an individual shall be signed as noted on the Bid Form.

- **B.** Bids 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.** Bids 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.

**7.0 - RECEIVING BID SUBMITTALS:** Only bids submitted on MissouriBUYS shall be accepted; no hard copy bids shall be accepted.

- **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.

- **B.** Submittals will be received as shown in and required by the Bid Form. Submittals will be completed so as to include insertion of all amounts for alternate bids, unit prices and cost accounting data, etc. Failure to complete all required information may be cause for rejection of bid.

- **C.** 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.
D. Bidders prices shall include all city, state and federal sales, excise and similar taxes which may be lawfully assessed in connection with his performance of work and purchase of materials to be incorporated in the work. THIS PROJECT IS NOT TAX EXEMPT.

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

F. The Owner reserves the right to waive infomalities in bid submittals and to reject any or all bids.

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 at – http://oa.mo.gov/facilities/vendor-links/contractor-forms.
Information regarding a Memorandum of Understanding which is one form of appropriate documentation located at [https://www.uscis.gov/e-verify/](https://www.uscis.gov/e-verify/). Submittal of this form and appropriate documentation is required before the award of any contract. In addition the contractor shall be responsible for compliance of these requirements by all subcontractors and suppliers at any tier associated with this contract.

10.0 – SERVICE-DISABLED VETERANS

A. For the purposes of these instructions, the terms “service-disabled veteran” and “service-disabled veteran business” have the same meanings as set forth in section 34.074, RSMo.

B. The State of Missouri has a goal of awarding three percent of all construction projects to service-disabled veterans. Furthermore, service-disabled veteran businesses doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places 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 any service-disabled veteran business’s bid amount(s) by three percent of the lowest bid amount(s). 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.

C. Any bidder who is qualified as a Missouri service-disabled veteran pursuant to Section 34.074, RSMo, must complete and submit with the bid the MISSOURI SERVICE DISABLED VETERAN BUSINESS form and provide the specified documentation in accordance with the instructions provided therein. This form can be obtained at: [http://oa.mo.gov/facilities/vendor-links/contractor-forms](http://oa.mo.gov/facilities/vendor-links/contractor-forms).

11.0 - 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.

12.0 - 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.**

13.0 - 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:

1.0 DEFINITIONS


2. "MINORITY":
   a. "Black Americans," which includes persons having origins in any of the black racial groups of Africa;
   b. "Hispanic Americans," which includes persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish culture or origin regardless of race;
   c. "Native Americans," which includes persons who are American Indians, Eskimos, Aleuts, or Native Hawaiians;
   d. "Asian-Pacific Americans," which includes persons whose origins are from Japan, China, Taiwan, Korea, Vietnam, Laos, Cambodia, the Philippines, Samoa, Guam, the U.S. Trust Territories of the Pacific, or the Northern Marianas; or
   e. "Asian-Indian Americans," which includes persons whose origins are from India, Pakistan or Bangladesh.

3. "MINORITY BUSINESS ENTERPRISE": A business concern which is at least fifty-one percent (51%) owned by one (1) or more minority as defined in 2. "MINORITY" above or in the case of any publicly-owned business, fifty-one percent (51%) of the stock of which is owned by one (1) or more minority as defined in 2. "MINORITY" above AND whose management and daily business operations are controlled by one (1) or more minority as defined herein.


5. "WOMEN BUSINESS ENTERPRISE": A business concern which is at least fifty-one percent (51%) owned by one (1) or more women or in the case of any publicly-owned business at least fifty-one percent (51%) of the stock of which is owned by one (1) or more women AND whose management and daily business operations are controlled by one (1) or more women.


7. "SERVICE-DISABLED VETERAN": Any individual who is service disabled as certified by the appropriate federal agency responsible for the administration of veterans’ affairs.

8. "SERVICE-DISABLED VETERANS ENTERPRISE": A service disabled veteran business as defined by Section 34.074, RSMo, meaning a business concern which is at least fifty-one percent (51%) owned by one (1) or more service-disabled veterans or in the case of any publicly-owned business at least fifty-one percent (51%) of the stock of which is owned by one (1) or more service-disabled veterans AND whose management and daily business operations are controlled by one (1) or more service disabled veterans.

2.0 MBE/WBE/SDVE PROGRAM REQUIREMENTS

A. For bids where MBE, WBE and or SDVE goals are greater than zero percent (0%) as noted in the “Invitation for Bid,” the following provisions shall apply

1. MBE/WBE/SDVE Percentage Goals:
   a. The bidder shall have as a goal subcontracting not less than the percentages stated on the Bid Form for MBE, WBE and SDVE firms.

2. Computation of MBE/WBE/SDVE Percent Goal Participation:
   a. The total dollar value of the work granted to the MBE, WBE or SDVE by the successful bidder shall be counted towards the applicable goal of the entire contract.
   b. A bidder may count toward the MBE/WBE/SDVE goals only expenditures to certified MBE’s, WBE’s, or SDVE’s that perform a commercially useful function in the work of a contract. A MBE, WBE, or SDVE is considered to perform a commercially useful function when it is responsible for executing a distinct element of the work contract and carrying out its responsibilities by actually performing, managing and supervising the work or providing supplies or manufactured materials. A bidder who is a MBE, WBE or SDVE may count 100% of the contract towards the MBE, WBE or
SDVE goal. (NOTE: MBE firms who bid as general contractors are expected to obtain WBE and SDVE participation; WBE firms who bid as general contractors are expected to obtain MBE and SDVE participation; and SDVE firms who bid as general contractors are expected to obtain MBE and WBE participation to meet the project’s separate goals.)

c. Bidder may count toward its MBE/WBE/SDVE goals expenditures for materials and supplies obtained from certified MBE, WBE, or SDVE suppliers and manufacturers, provided that the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.

d. A bidder may count towards the MBE/WBE/SDVE goals that portion of the total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier to any subcontractor at any tier, provided that the MBE, WBE, or SDVE properly assumes responsibility for the work as outlined in 2.A.2.b and 2.A.2.c above.

e. A bidder may count towards the MBE/WBE/SDVE goals that portion of the total dollar value 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.

3. Certification by bidder of MBE/WBE/SDVE Subcontractors:

a. The bidder shall submit with his bid 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 on the contract work.

b. The bidder may determine the status of certification of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO) MBE/WBE directory (https://apps1.mo.gov/MWBCertifiedFirms/); and the eligibility of a SDVE subcontractor or supplier by referring to the Division of Purchasing and Materials Management 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/). Additional information, clarifications, etc., regarding the listings in the Directory may be obtained by calling the Division at (573) 751-3339 and asking to speak to the Contract Specialist of record as shown in Section 007300, Supplementary Conditions.

c. If the proposed subcontractor is certified as a MBE/WBE firm by any other State of Missouri agency or any Missouri city or county government agency, the bidder shall so note and provide particulars. Other known State of Missouri entities providing certification are:

   Mountain Plains Minority Supplier Development Council 816-221-4200
   Human Relations Department, KCMO 816-274-1432
   Lambert International Airport 314-551-5000
   Metro (formerly Bi-State Development Agency) 314-982-1457
   St. Louis Development Corporation 314-622-3400 Ext. 362
   St. Louis Minority Business Council 314-241-1073
   SBA 8/St. Louis, MO 314-539-6600
   Missouri Department of Transportation 573-751-2859
   National Women Business Owners Corp. 561-848-5066

   (Missouri firms only)

4. Waiver of MBE/WBE/SDVE Participation:

a. The bidder is required to make a good faith effort to locate and contract with MBE’s, WBE’s and SDVE’s. If a bidder has made a good faith effort to secure the required MBE’s, WBE’s and SDVE’s and has failed, he may submit with his bid the information requested in “MBE/WBE/SDVE Good
Faith Effort (GFE) Determination.” The Director will review the bidder’s actions as set forth in the bidder's Application for Waiver, the ability or success of other bidders to obtain MBE, WBE, or SDVE participation in their bids, and any other factors deemed relevant by the Director, to determine if a good faith effort has been made to meet the applicable percentage goals. If the bidder is judged not to have made 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 SDVE participation will be determined to be responsive to the MBE/WBE/SDVE participation goals of the contract regardless of the percent of MBE/WBE/SDVE participation, provided the bid is otherwise acceptable.

b. In reaching a determination of good faith, the Director may evaluate, but is not limited to, the following factors:

1. How subcontractors were contacted initially, the specific project information provided and the documentation to support that contact;
2. How project plans and specifications were provided to MBE/WBE/SDVE subcontractors;
3. The names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;
4. Attempts to follow-up with MBE, WBE or SDVE subcontractors prior to bid to negotiate price, scope of work, or make other adjustments or clarifications;
5. Amount of bids received from any of these subcontractors;
6. Bid accepted from one of these subcontractors or reasons for rejecting bids;
7. The MBE, WBE, or SDVE suppliers contacted, date of contact, material or equipment, amounts of quotes;
8. The ability or success of other bidders to obtain the MBE/WBE/SDVE participation in their bids.

c. If MBE/WBE/SDVE goals have been identified on Section 004113-BID FORM, ALL bidders are required to submit all appropriate MBE/WBE/SDVE documentation before the stated time and date set forth in the “Invitation for Bid”. Failure to provide this information by the specified date and time will be grounds for rejecting the bid.

MBE/WBE/SDVE forms may be accessed at https://oa.mo.gov/facilities/vendor-links/contractor-forms. 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.”

d. The Director reserves the right to provide bidders the opportunity to correct or amplify the documented information received concerning MBE/WBE/SDVE goals. The additional information will be transmitted to Facilities Management Design and Construction within two (2) working days of a phone or facsimile or email request from the Director's representative.

3.0 CONTRACTOR REQUIREMENTS

For contracts where there are MBE/WBE/SDVE participation goals as noted in the “Invitation for Bid,” the following provisions shall apply:

A. The Contractor is bound to subcontracting or obtaining materials in amounts not less than the dollar amount indicated in the awarded contract to MBE/WBE/SDVE (s) unless that amount is revised in writing by the Owner’s representative.

B. If the Contractor fails to meet or maintain the participation requirements contained in the Contractor’s bid, he must satisfactorily explain to the Director or his Designee why the requirement cannot be achieved and why meeting the requirement was beyond the Contractor's control.

C. If the Director finds the Contractor's explanation unsatisfactory, the Director may take any appropriate action including, but not limited to:
1. Declaring the Contractor ineligible to participate in any Facilities Management, Design and Construction contracts for a period not to exceed twelve (12) months; and

2. Directing that the Contractor be declared non-responsive to the “Invitation for Bid,” or in breach of this contract.

D. If a MBE, WBE, or SDVE is replaced during the course of this contract, the Contractor shall replace it with a similar MBE, WBE, or SDVE OR make a good faith effort to replace it with another MBE, WBE, or SDVE. All substitutions shall be approved by the Owners Representative.

E. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. As a minimum, the dollar-value of work completed by each MBE, WBE, or SDVE subcontractor during the preceding month and as a cumulative total shall be reported with each monthly application for payment. A final report shall include the total dollar-value of work completed by each MBE, WBE, and SDVE subcontractor during the total contract.
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-MO National Grd.

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: DINING FACILITY (DFAC) ADDITION
CAMP CLARK BLDG 430
NEVADA, MISSOURI

Project Number: T1716-02

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 130 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 $700 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: $  

DELETE THE ALTERNATE INFORMATION IF NOT USED

The Owner accepts the following Alternate Bids:

Alternate One: $  

TOTAL CONTRACT AMOUNT: ($CONTRACT AMOUNT)

UNIT PRICES:

The Owner accepts the following Unit Prices:

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.

INSERT UNIT PRICE DESCRIPTIONS AND QUANTITY INCLUDED IN THE BASE BID FROM SECTION 01026

OR

IF NO Unit Prices are used, type “NOT APPLICABLE”

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 5% 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., Acting 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

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

STATE OF  COUNTY (OR CITY OF ST. LOUIS)

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
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

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**

<table>
<thead>
<tr>
<th>SPECIFIED PRODUCT</th>
<th>SUBSTITUTION REQUEST</th>
</tr>
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<tbody>
<tr>
<td>NAME, BRAND</td>
<td></td>
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<tr>
<td>CATALOG NO.</td>
<td></td>
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<tr>
<td>MANUFACTURER</td>
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<td>VENDOR</td>
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</tbody>
</table>

**PREVIOUS INSTALLATIONS**

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>ARCHITECT/ENGINEER</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>DATE INSTALLED</td>
</tr>
</tbody>
</table>

**SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT**

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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
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
MBE/WBE/SDVE PROGRESS REPORT

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

<table>
<thead>
<tr>
<th>CHECK</th>
<th>MBE</th>
<th>WBE</th>
<th>SDVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL CONTRACT AMOUNT</td>
<td>$</td>
<td></td>
<td></td>
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</table>

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

<table>
<thead>
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<th>ITEM OF WORK</th>
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ORIGINAL: Attach to ALL Progress and Final Payments
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)
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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.


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.


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.


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.

F. 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 property not belonging to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all applicable 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 ensure 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.

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 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
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 without 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.

Above referenced items must be received by the Owner within twelve (12) 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 to 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 be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantially 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

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 ISO 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 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.

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.
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: Cory Wilson
   Olsson
   1301 Burlington St,
   Kansas City, MO  64116
   Telephone:  816-361-1177; Fax:  816-361-1888
   Email: cwilson@olsson.com

   Project Manager and Construction Representative: Bill Edwards
   Missouri National Guard-CFMO Office
   6819a North Boundary Road, Jefferson City, MO 65101
   Telephone:  573-418-7253; Fax:  573-638-9746
   Email: Billy.j.edwards66.nfg@mail.mil

   Contract Specialist: Marlene Blackburn
   Division of Facilities Management, Design and Construction
   301 West High Street, Room 730
   Jefferson City, Missouri  65102
   Telephone:  573-522-6035; Fax:  573-751-7277
   Email:  marlene.blackburn@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 10 complete sets of drawings and specifications at no charge.
   B. The Owner will furnish the Contractor with approximately 10 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. 26
Section 112
VERNON 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 8, 2019

Last Date Objections May Be Filed: April 8, 2019

Prepared by Missouri Department of Labor and Industrial Relations
<table>
<thead>
<tr>
<th>OCCUPATIONAL TITLE</th>
<th>** Date of Increase</th>
<th>Basic Hourly Rates</th>
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*The Division of Labor Standards received less than 1,000 reportable hours as required by RSMo 290.257.4(b). Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center, in accordance with RSMo 290.257.2.

**Annual incremental Increase

ANNUAL WAGE ORDER NO. 26

3/19
# Heavy Construction Rates for VERNON County

## Table of OCCUPATIONAL TITLE and Basic Hourly Rates

<table>
<thead>
<tr>
<th>OCCUPATIONAL TITLE</th>
<th>** Date of Increase</th>
<th>Basic Hourly Rates</th>
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</thead>
<tbody>
<tr>
<td>Carpenter</td>
<td></td>
<td>$21.22*</td>
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<tr>
<td>Millwright</td>
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<td>$21.22*</td>
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<tr>
<td>Lineman - Tree Trimmer</td>
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<td>Groundman</td>
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<tr>
<td>Group IV</td>
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</tr>
</tbody>
</table>

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 as required by RSMo 290.257.4(b). Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center, in accordance with RSMo 290.257.2.*
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.
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Various work to be performed shall include any and all items in the following categories:
   1) General Requirements
   2) General Construction Work, including but not limited to cutting, patching, finishing, Masonry, structural steel, foundations, concrete pathways, concrete base pads, and painting.
   3) Mechanical Work
   4) Electrical Work
   5) Fire Protection
   6) Control and Monitoring Work

B. The Contractor agrees to complete the work under this contract within a maximum time period of 130 working days (or less as dictated by submitted schedule), starting upon receipt of the Notice of Intent To Award. This includes all allotted bad weather days.

1.2 WORK UNDER OTHER CONTRACTS

A. The following work below is related to this project is being completed under separate contract. This work must be coordinated with, but is not included in this contract.
   1) Pre-Fabricated Kitchen Cooler/Freezer Enclosures (field assembled by contractor).

1.3 DUTIES OF THE CONTRACTOR

A. Except as specifically noted, provide and pay for:
   1) Labor, materials and equipment
   2) Tools, construction equipment and machinery
   3) Other facilities and services necessary for proper execution and completion of the work

B. Pay all legally required sales, consumer and use taxes.

C. Unless noted otherwise, secure and pay for, as necessary, the execution and completion of the work as follows:
   1) Permits
   2) Government fees
   3) Licenses
   4) Construction easements
   5) Rental of adjacent properties

D. Give required notices.

E. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of the work.
F. Promptly submit to the Owner's Representative written notice of any observed variance of the Contract Documents from legal requirements. It is not the Contractor's responsibility to make certain these documents comply with applicable codes and regulations.

G. Enforce good order among employees and employ only persons skilled in assigned tasks.

1.4 CONTRACTORS USE OF PREMISES

A. General: Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy and use by the public.
   1) Contractor shall be limited to areas of work only, which include vestibules, main lobbies, electrical rooms, and conference room.

B. Confine operations to areas as required by laws, ordinances, permits, and within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
   1) Do not unreasonably encumber site with materials or equipment.
   2) Do not load structure with weight that will endanger structure.
   3) Assume full responsibility for protection and safekeeping of products stored on premises.
   4) Obtain and pay for use of additional storage or work areas needed for operations.
   5) Limit use of site for work, storage, loading, parking, and temporary offices.

C. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees 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.

D. Safety: The Contractor shall provide a comprehensive safety package, consistent with Owner's site safety program, for coordination with all subcontractors and project personnel under his supervision. Safety program shall be submitted to Owner for approval prior to construction initiation. All Contractors are required to comply with all of the safety and health regulations of federal, state, local laws, OSHA and Owner's safety policies. Further details on safety requirements are included in specification section 013101, which contains occupational safety requirements that are required of all Contractors and their employees while on Owner's property.

1.5 OWNER OCCUPANCY

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire construction period. 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.

B. A Certificate of Substantial Completion will be executed for each specific portion of the Work to be occupied prior to Owner occupancy.

C. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Coordinate final acceptance with commissioning agent for acceptance. Upon occupancy the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

1.6 SEQUENCE OF CONSTRUCTION

A. All methods of procedure, phasing, scheduling, and sequencing of work shall be submitted to owner and engineer prior to the start of any work.
1.7 SEQUENCE OF WORK

A. Coordinate the work with the Owner so that it will not interfere with Owner's operation of the building.

B. The Contractor shall be responsible for a scheduled sequence in performing the work, so that it will not interfere with the Owner's operation in the building. The Contractor shall make temporary alterations and connections as required to execute the work so that all operations and services in the building are maintained with minimum possible interruption. Temporary shutdowns shall be segregated and shall be of the shortest possible duration. All facilities and services shall be kept in continuous operation unless specific permission to the contrary is granted by the Owner. Discussion of any service interruption can only occur with written approval from Bluebird. SMOPs, controls, sequences shall be approved.

C. Generators shall be used as much as possible to avoid any building outages. The contractor shall include in his bid all fuel required to maintain duration on stand-by power.

D. Where the work on any system, systems, or equipment is performed by more than one trade or where the work on multiple systems or equipment performed by different trades effects the Owner's operation in the same space, the work of all the trades shall be scheduled, sequenced, and coordinated to the greatest possible extent so as to provide for the least number of interruptions, the shortest possible interruption in equipment and system operation, and to prevent interference with the Owner's operation. Discussion of any service interruption can only occur with written approval from Bluebird. SMOPs, controls, sequences shall be approved.

E. Down-time of all equipment and/or systems shall be coordinated with the Owner's Authorized Representative, and shall require a detail "Method of Procedure" elsewhere in these specifications. No interruption shall occur in the operation of equipment or systems unless approved by the Owner's Authorized Representative. Olsson and owner shall have right to review and approve any MOP prior to initiating work.

F. The performance of work in this facility which requires the interruption of critical equipment shall only occur during normal business hours with parties from Bluebird, Olsson, and others available for attendance and via emergency response.

G. This work shall be coordinated fully with the Owner's Authorized Representative and shall be performed under conditions approved by the Owner's Representative. A "Method of Procedure will be submitted and approved by the Owner. Where work requires more than one work shift (6:00 P.M. to 6:00 A.M.), the contractor shall pay no extras and should include this off-shift hours within his bid should work go into these time frames.

H. During the term of the contract it may be necessary to perform certain other portions of the original contract work (for certain systems or equipment or in certain spaces as directed by the Owner) between the hours of 6:00 P.M. and 6:00 A.M. or during other hours other than normal work hours. Should this occur, the Owner will need notice at least 5 working days prior to this off-shift work.

1) The schedule and sequence shall be as approved by the Owner's Representative and shall be documented by the Contractors approved "MOP".

I. When any work is to be performed during hours other than the normal hours of the Building, the Contractor shall make prior arrangements with the Owner for entrance into the Building and the space where work is to be performed. If any work is to be performed during a weekend, arrangements must be made with the Owner not later than Wednesday preceding the weekend.

J. Certain equipment areas of this building require cooling continuously and cannot be brought off line for a period greater than 15 minutes for any reason. Therefore the contractor shall provide any temporary cooling equipment required to maintain the environmental control in these areas.

K. In general, this building contains a great deal of high tech equipment which requires cooling to remain operational. The Contractor shall take all necessary precautions to insure that the Owner’s equipment...
which is heat sensitive remains operational. Employment of portable fans and portable cooling equipment shall be utilized when cooling systems must be shut down for periods greater than 15 minutes.

L. Where work is performed on equipment, or systems, or a part of a system and other associated work or associated control cannot be completed until a later date, temporary connections, controls, and measures shall be provided for the proper operation and control to at least provide operation and control equal to that which is existing.

END OF SECTION 010000
SECTION 010270 - APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. The Contractor's Construction Schedule and Submittal Schedule are included in Section "Submittals".

1.2 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

B. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
   1) Contractor's construction schedule.
   2) Application for Payment form.
   3) List of subcontractors.
   4) Schedule of allowances.
   5) Schedule of alternates.
   6) List of products.
   7) List of principal suppliers and fabricators.
   8) Schedule of submittals.

C. Submit the Schedule of Values to the owners representative/engineer at the earliest feasible date, but in no case later than seven days before the date scheduled for submittal of the initial Application for Payment.

D. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

E. Format and Content: The Contractor shall submit a format for the Schedule of Values to the Owner or Owner’s Representative for approval.

F. Identification: Include the following Project identification on the Schedule of Values:
   1) Project name and location.
   2) Name of the Architect/Engineer.
   3) Project number.
   4) Contractor's name and address.
   5) Date of submittal.

G. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
   1) Generic name.
   2) Related Specification Section.
   3) Name of subcontractor.
4) Name of manufacturer or fabricator.
5) Name of supplier.
6) Change Orders (numbers) that have affected value.
7) Dollar value.
8) Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.

H. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
   1) Round amounts off to the nearest whole dollar: the total shall equal the Contract Sum.

I. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

J. Unit Cost Allowances: Show line item value of unit cost allowances as a product of unit cost times measured quantity as estimated from the best indication in the Contract Documents.

K. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
   1) At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

L. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Owner’s Representative and paid for by the Owner.
   1) The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is the 15TH day of each month. The period of construction Work covered by each Application for Payment is the period ending 15 days prior to the date for each progress payment and starting the day following the end of the preceding period.

C. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment.

D. Payment Application Forms: Use AIA forms.

E. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
   1) Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
2) Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

F. Transmittal: Submit three executed copies of each Application for Payment to the Owner’s Representative by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.

1) Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

G. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from subcontractors or sub-subcontractors and suppliers for the construction period covered by the previous application.

1) Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.

2) When an application shows completion of an item, submit final or full waivers.

3) The Owner reserves the right to designate which entities involved in the Work must submit waivers.

H. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.

1) Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:

   (a) List of subcontractors.
   (b) List of principal suppliers and fabricators.
   (c) Schedule of Values.
   (d) Contractor's Construction Schedule (preliminary if not final).
   (e) Schedule of principal products.
   (f) Schedule of unit prices.
   (g) Submittal Schedule (preliminary if not final).
   (h) List of Contractor's staff assignments.
   (i) List of Contractor's principal consultants.
   (j) Copies of building permits.

   (k) Copies of authorizations and licenses from governing authorities for performance of the Work.
   (l) Initial progress report.
   (m) Report of preconstruction meeting.
   (n) Certificates of insurance and insurance policies.
   (o) Performance and payment bonds (if required).
   (p) Data needed to acquire Owner's insurance.
   (q) Initial settlement survey and damage report, if required.

I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Administrative actions and submittals that shall proceed or coincide with this application include:
1) Occupancy permits and similar approvals.
2) Warranties (guarantees) and maintenance agreements.
3) Test/adjust/balance records.
4) Maintenance instructions.
5) Meter readings.
6) Start-up performance reports.
7) Change-over information related to Owner's occupancy, use, operation and maintenance.
8) Final cleaning.
9) Application for reduction of retainage, and consent of surety.
10) List of incomplete work, recognized as exceptions to the Owner Representative’s Certificate of Substantial Completion.

K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
1) Completion of Project closeout requirements.
2) Completion of items specified for completion after Substantial Completion.
3) Assurance that unsettled claims will be settled.
4) Assurance that work not complete and accepted will be completed without undue delay.
5) Transmittal of required Project construction records to Owner.
6) Certified property survey.
7) Proof that taxes, fees and similar obligations have been paid.
8) Removal of temporary facilities and services.
9) Removal of surplus materials, rubbish and similar elements.
10) Change of door locks to Owner's access.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 010270
SECTION 010350 - MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections: The following sections contain requirements that relate to this section:

1) Division 1 Section “Submittals” for requirements for the Contractor's Construction Schedule.

2) Division 1 Section “Application for Payment” for administrative procedures governing applications for payment.

3) Division 1 Section “Product Substitutions” for administrative procedures for handling requests for substitutions made after award of the Contract.

1.2 MINOR CHANGES IN THE WORK

A. Supplemental instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Owner's Representative on an Owner approved amendment form. Alternatively, the Contractor may elect to use AIA form G710, Architect’s Supplemental Instructions, to authorize these changes.

1.3 CHANGE ORDER PROPOSAL REQUEST

A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Owner’s Representative, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.

1) Proposal requests issued by the Owner’s Representative are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.

2) Unless otherwise indicated in the proposal request, submit to the Owner’s Representative for the Owner's review an estimate of cost necessary to execute the proposed change.

3) Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

4) Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Owner’s Representative.

1) Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

2) Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

3) Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4) Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.
C. Proposal Request Form: The Contractor shall submit Change Order Proposal Requests on a Change Order Request form approved by Owner and Owner’s Representative. Alternatively, the Contractor may elect to use AIA Document G 709 for Change Order Proposal Requests.

1.4 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect/Engineer may issue a Construction Change Directive, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. The Architect/Engineer shall use an Owner Approved form provided by the Construction Manager. Alternatively, the Owner and Construction Manager may elect to use AIA Form G714 to issue Construction Change Directives.

1) The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1) After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.5 CHANGE ORDER PROCEDURES

A. Upon the Owner’s approval of a Change Order Proposal Request, the Owner’s Representative will issue a Change Order for signatures of the Owner and Contractor on an Owner Approved form, as provided in the Conditions of the Contract. Alternatively, the Owner may elect to handle Change Orders on AIA Form G701

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

A. Contractor shall submit document forms for approval by Owner and Owner’s Representative which cover the following items in this Section: Minor Changes in Work, Change Order Proposal Request, Construction Change Directive and Change Order Procedures. The Contractor and Owner will use AIA Forms for any or all of these documents.

END OF SECTION 010350
SECTION 010400 - PROJECT COORDINATION

PART 1 - GENERAL

1.1 SUMMARY
A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
   1) Coordination
   2) Administrative and supervisory personnel
   3) General installation provisions
   4) Cleaning and protection.
B. Progress meetings, coordination meetings and preinstallation conferences are included in Section "Construction Progress".
C. Requirements for the Contractor's Construction Schedule are included in Section "Submittals".

1.2 GENERAL
A. The Contractor has full responsibility and authority regarding the scheduling and coordination of work.
B. All Subcontractors under and not under contract with the Contractor, shall abide by the project schedules and coordination requests made by the Contractor.
C. The Contractor shall have a competent superintendent at the site at all times when there is an employee of the Contractor or an employee of any subcontractor on the site. Due to the nature of this project, there will be no exceptions to this rule.
D. The Owner's Representative has full authority and responsibility for the work. All dealings and decisions regarding execution of the work shall be through him.
E. The Contractor communicates directly with the Owner's Representative, Subcontractors, vendors, and suppliers.
F. The Subcontractors shall coordinate with the Contractor who has the overall responsibility for coordination of the work.

1.3 COORDINATION
A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
   1) Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
   2) Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
B. Make adequate provisions to accommodate items scheduled for later installation.
C. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
1) Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

D. Project Meetings: Prepare and submit a detailed plan for approval by Owner which specifies administrative and procedural requirements for project meetings. At a minimum project meetings should include Pre-Construction Conferences, Pre-Installation Conferences, Coordination Meetings and Progress Meetings. The plan should include detailed descriptions for each meeting type consisting of a list of typical agenda items, attendees list, meeting schedules, utilization of meeting minutes, report generation and schedule updates.

E. Schedules: Prepare and submit a detailed plan for approval by Owner which specifies the development of project schedules and details the administrative and procedural requirements for generating reports. The construction schedule should be developed based on the Critical Path Method (CPM) and shall include as a minimum such critical items as:
   1) Long lead time procurement activities;
   2) Contract phasing activities;
   3) Activation and testing activities;
   4) Milestone dates for contract phasing requirements;
   5) Buyer-furnished equipment activities;
   6) Logic restraints reflecting the flow of manpower;
   7) Utility tie-in activities;
   8) Clean-up and punchlist activities
   9) Activity durations in working days;
  10) Shop drawing, submittals and approval;
  11) Inspections and Tests.

F. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1.4 SUBMITTALS

A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
   1) Show the interrelationship of components shown on separate Shop Drawings.
   2) Indicate required installation sequences.
   3) Comply with requirements contained in Section "Submittals."

B. Staff Names: Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
   1) Post copies of the list in the construction trailer.
PART 3 - EXECUTION

1.5 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.


F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

1.6 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1) Excessively high or low temperatures.
2) Thermal shock.
3) Excessively high or low humidity.
4) Air contamination or pollution.
5) Water or ice.
6) Solvents.
7) Chemicals.
8) Light.
9) Puncture.
10) Abrasion.
11) Heavy traffic.
12) Soiling, Staining and Corrosion
13) Rodent and insect infestation.
14) Electrical current.
15) High speed operation,
16) Improper lubrication,
17) Unusual wear or other misuse.
18) Contact between incompatible materials.
19) Destructive testing.
20) Misalignment.
21) Excessive weathering.
22) Unprotected storage.
23) Improper shipping or handling.
24) Theft.
25) Vandalism.

END OF SECTION 010400
REQUEST FOR INFORMATION

Project Name: **DFAC BLDG. #430 ADDITION**

Project No.: **T1716-02**

Request From:

Name ________________________________
Company ________________________________
Address ________________________________

Phone ________________________________
Fax ________________________________
Email ________________________________
RFI # ________________________________

Please Clarify the Following:

Drawing #: ________________________________
Specification Section: ________________________________

Request Response By: ________________________________

QUESTIONS (Number each one):

ANSWER (List answers with same number as question):
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.
   1. Certain items 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:
   1. Weather allowances.

C. Related Sections include the following:
   1. Division 1 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% 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 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Weather Allowance: Included within the completion period for this Project Twelve (12) “bad weather” days.

END OF SECTION 012100
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 1 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. Division 1 Section 012100 "Allowances" for procedural requirements for handling and processing allowances.
2. Division 0 Section 00700, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling requests for substitutions made after Contract award.
3. Division 0 Section 00700, Article 4.0 "Changes in the Work" for Contract Change requirements.

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. A 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 RFI 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 Contractor submits a 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 a RFI will cause a change to the requirements of the contract document, 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 "Designer’s Supplemental Instructions" (DSI).

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 Sum or the Contract Time. The proposed change description
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 quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCESSING FORMS

A. All forms are available at the Facilities Management, Design and Construction website: http://oa.mo.gov/fmdc/dc/contractorforms.htm

END OF SECTION 012600
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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

1. Coordination with facility personnel.
2. Coordination with personnel from other agencies.
3. Coordination with other contracts let by the Owner in connection with this work.
4. Coordination with the Construction Representative concerning special requirements in connection with this work.

1.3 COORDINATION

A. Partnering: The Owner desires to create a partnering relationship with the Contractor, principal subcontractors, major suppliers and the Consultant. This relationship will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. The objectives are the effective and efficient contract performance and project completion within budget and schedule—all in accordance with the drawings and specifications.

1. This partnering relationship will be bilateral in makeup and participation. Expenses for the Facilitator and facilities shall be paid by the Owner. No additional costs shall be allowed to the Contractor.
2. To implement this partnering initiative, project representatives for the Contractor, Consultant and Owner will meet to make arrangements for a seminar/team building workshop. These individuals will make arrangements to determine attendees at the workshop. The Owner will provide a staff member to act as a facilitator or hire an independent facilitator. With the facilitator, the agenda of the workshop, duration and location of the workshop will be finalized. People required to be in attendance at the workshop will be key site personnel from the Contractor, Consultant and Owner. The management of these individuals will also be in attendance at the workshop.
3. Follow-up workshops may be held periodically throughout the duration of the contract as agreed by the Contractor, Consultant and Owner.
4. The establishment of a partnering charter on this project will not alter the terms and conditions of the contract.

B. The Contractor shall coordinate construction operations for this project with the Construction Representative and facility personnel to assure efficient and orderly completion of the Work.

1. Schedule construction operations in the sequence required to obtain the best results.
2. Coordinate construction operations to allow existing facility to remain in operation while the Work is being performed.
3. Coordinate construction operations to accommodate construction operations of other contracts let by the Owner.

C. The Contractor shall, where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports and attendance at meetings.
1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

D. Administrative Procedures: The Contractor shall coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules.
2. Installation and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Project closeout activities.

1.4 SUBMITTALS

A. Staff Names: Within eighteen (18) calendar days of commencement of construction operations, the Contractor shall submit a list of the Contractor’s principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. The list shall identify individuals, their duties, responsibilities, addresses and telephone numbers.

1. Post copies of the list in the Project meeting room, the temporary field office and at each temporary telephone.

B. Schedule: Within eighteen (18) calendar days of commencement of construction operations, the Contractor shall submit a schedule which coordinates the construction activities of this work with the work of other contracts. See Division 01320-Schedules for specific requirements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. A pre-construction conference will be held 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 conference, the construction procedures and information necessary for submitting payment requests will be discussed and materials distributed, along with any other pertinent information.

B. Coordination drawings of the various trade’s work as applicable shall be executed prior to commencement of the work.

END OF SECTION 013100
SECTION 013200 – CONSTRUCTION PROGRESS DOCUMENTATION

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 1 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 Applicable)

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

A. The Contractor shall submit to the Designer, within ten (10) working days following the Notice to Proceed, a progress schedule 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 01020 – 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 is to indicate start and completion dates for the activity. The Contractor is to 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.
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. Mockups.
5. Fabrication.
6. Sample testing.
7. Deliveries.
8. Installation.
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 01300 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 is to 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, Architect, and each party involved in performance of portions of the Work where inspections and tests are required.

END OF SECTION 013200
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 1 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.
5. Warranties.

B. Administrative Submittals: Refer to General and Supplementary Conditions other applicable Division 1 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. Notification, 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

1.4 ELECTRONIC SUBMITTALS

A. Documents submitted electronically, via email or media, shall comply with the following:

1. Email subject lines shall contain the project number, site name and a short description of the topic. Example Subject Line: T1208-01 ISTS-PVC Pipe.

2. Product submittals and shop drawings:
   a. Submittal files shall be named as “S-Division Number-Sequential Number”. Re-submittals shall begin with RS1, RS2, etc. Example File Name: S-051200-001.

3. Project Forms:
   a. DSI’s, RFI’s, RFP’s, etc. shall be named as “Form Name-Sequential Number-Short Description”. Example File Name: RFP 001-Add Repair.

4. Email Attachments:
   a. Due to mailbox size restrictions, attachments shall not be larger than 3 MB.
   b. An internet file delivery service shall be used for files exceeding 3 MB.

5. File Types: The preferred file type is Portable Document Format (PDF). Image files are less desirable, but also acceptable.

6. All electronic file documents shall be rotated and sized properly.

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

1.6 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. Include the following information:
   a. Manufacturer’s printed recommendations.
   b. Compliance with trade association standards.
   c. Compliance with recognized testing agency standards.
   d. Application of testing agency labels and seals.
   e. Notation of dimensions verified by field measurement.
   f. Notation of coordination requirements.

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

1.7 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. Include 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. Refer to other Sections for samples to be returned to the Contractor for incorporation in the Work. Such samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of sample submittals.
d. 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.

3. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.

a. The Contractor shall comply with submittal requirements to the fullest extent possible. The Contractor shall process transmittal forms to provide a record of activity.

1.8 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.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

Contractor shall submit the following information for materials and equipment to be provided under this contract.

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<th>SECTION</th>
<th>DESCRIPTION</th>
<th>Shop Drawings/Schedules</th>
<th>Product Data</th>
<th>Samples</th>
<th>Certifications/Qualifications</th>
<th>Manufacturer’s Instructions</th>
<th>Test / Research Reports</th>
<th>Inspection Report</th>
<th>Wiring Diagrams</th>
<th>Record Photographs</th>
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END OF SECTION 013300
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control services.

B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Owner’s Representative.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

E. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.

F. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

G. Requirements for the Contractor to provide quality control services required by the Owner’s Representative, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 RESPONSIBILITIES

A. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.

B. The Contractor shall employ and pay an independent agency, to perform specified quality control services.

C. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.

D. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

E. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

F. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:

1) Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
2) Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.

3) Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.

4) Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

5) Security and protection of samples and test equipment at the Project site.

G. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Owner’s Representative and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

H. The agency shall notify the Owner’s Representative and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

I. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

J. The agency shall not perform any duties of the Contractor.

K. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

L. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.3 SUBMITTALS

A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Owner’s Representative, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.

B. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

C. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:

1) Date of issue.
2) Project title and number.
3) Name, address and telephone number of testing agency.
4) Dates and locations of samples and tests or inspections.
5) Names of individuals making the inspection or test.
6) Designation of the Work and test method.
7) Identification of product and Specification Section.
8) Complete inspection or test data.
9) Test results and an interpretations of test results.
10) Ambient conditions at the time of sample-taking and testing.
11) Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
12) Name and signature of laboratory inspector.
13) Recommendations on retesting.

1.4 QUALITY ASSURANCE

A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

B. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 014000
SECTION 015000 - TEMPORARY FACILITIES AND SERVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Temporary utilities.
   2. Temporary construction.
   3. Protective facilities.
   4. Employee facilities.
   5. Administrative facilities.
   6. Temporary services.
   7. Required temporary facilities and services include but are not limited to:
      a. Drinking water facilities.
      b. Dust control services.
      c. Fire protection facilities, other than piped utilities.
      d. Public protective facilities required by law.
      e. Termite extermination services.
      f. Safety fence.
      i. Waste disposal service.
      j. Water supply.
         1. Include water service and sewer usage charges.
      k. Use of permanent water service.
      l. Cooling.
         2. Include cost of power used.
      m. Use of permanent heating, cooling, and ventilating systems.
      n. Electrical service, except extension cords.
         1. Include electric service usage charges.
      o. Temporary lighting.

1.02 SUBMITTALS

A. Copies of permits required by public authorities.

1.03 QUALITY ASSURANCE

A. Comply with requirements of governing authorities, as to type, quantity, location, and use of temporary facilities.

B. Comply with requirements of governing authorities, as to type and frequency of temporary services.

C. Comply with requirements of public utilities affected.

1.04 PROJECT CONDITIONS

A. Obtain easements where required.

B. Use of permanent facilities prior to substantial completion is subject to the owner's approval and conditions.
   1. Each permanent facility used for construction purposes shall be operated, maintained, and protected during such use by the original installer.
   2. Specified warranties shall not be reduced or voided by temporary use.
1.05 SEQUENCING AND SCHEDULING

A. Maintain required facilities until not needed or until shortly before substantial completion; remove facilities before substantial completion.
   1. Exception: Where use of permanent facilities is allowed.

B. Change over to use of permanent facilities, when applicable, as soon as possible, except when use of permanent facilities is not allowed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide materials which are both suitable for the use and durable enough to withstand the use and abuse to be expected.

B. Temporary Heating Units: UL labeled for the fuel used; do not use gasoline-burning, open burning, or solid fuel heaters or salamanders.
   1. Use equipment that is known to be safe and that will not damage work in progress.

2.02 TEMPORARY UTILITIES

A. Utilities:
   1. All temporary utilities will be paid for by the contractor.
   2. All permanent utilities will be paid for by the owner (i.e. city utility service, if required).

2.03 PROTECTIVE FACILITIES

A. Fire Protection Facilities: Provide at least the temporary facilities required by the authorities having jurisdiction.
   1. Fire extinguishers to be installed in the completed building shall not be used during construction.
   2. Put permanent facilities into operation as soon as possible.

2.04 EMPLOYEE FACILITIES

A. Temporary Lighting: Provide at least the lighting required by law.

2.05 ADMINISTRATIVE FACILITIES

A. Telephone Service:
   1. Provide at least one cellular on site.
   2. Display construction-related phone numbers at each phone.
      a. Fire emergency number.
      b. Rescue emergency number.
      c. Physician.
      d. Contractor's home office.
      e. Owner's representative.
      f. Architect's/Engineer’s representative.
      g. Major subcontractors’ home offices.

2.06 TEMPORARY CONSTRUCTION

A. Temperature Control and Ventilation Facilities: Provide adequate facilities:
1. To provide proper conditions for installation.
2. For drying and curing of completed work.
3. For protection from deterioration due to high or low temperatures and humidities.
4. To provide suitable working conditions.
5. Permanent equipment and facilities may be used.

B. Temporary Enclosures for Weather Resistance: When building enclosure is not yet complete but interior construction may be damaged by weather, provide temporary enclosures adequate to keep out weather.

PART 3 - EXECUTION

3.01 GENERAL

A. Cooperate with other contractors in location of temporary facilities.

3.02 TEMPORARY SERVICES

A. Waste Disposal Service: Provide contracted removal service at regular intervals.
   1. Remove waste at least once a week.
   2. When temperature exceeds or is expected to exceed 80 degrees F, remove at least twice a week.
   3. Provide waste collection containers for use of all contractors.

B. Dust Control Services: Keep down dust on a regular basis. This may involve routine water spraying of areas around cave space construction site.

C. Extermination Service: Provide termite extermination services.
   1. Exterminate below concrete footings before footings are poured.

3.03 TERMINATION AND REMOVAL

A. Remove temporary facilities when no longer needed, or when use of appropriate permanent facility is approved, but not later than substantial completion.
   1. Exception: When longer usage is requested by the architect or owner.

B. Complete permanent work delayed until removal of temporary facilities.

C. Permanent Facilities Used during Construction: Clean; replace parts that are worn in excess of that expected during normal usage.

END OF SECTION 015000
PART 1 - GENERAL

1.1 SUMMARY
A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittals."
C. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.
D. Procedural requirements governing the Contractor's selection of products and product options are included under Section "Materials and Equipment."

1.2 DEFINITIONS
A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions." The following are not considered substitutions:
   1) Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
   2) Revisions to Contract Documents requested by the Owner or the Owner’s Representative.
   3) Specified options of products and construction methods included in Contract Documents.
   4) The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.3 SUBMITTALS
A. Bid Period: The Owner will consider substitutions of equipment and material by manufacturers other than those listed in the specifications as follows:
   1) Substitutions shall be submitted at the time of the bid opening and shall accompany the construction bid. Substitutions shall be submitted on a separate letterhead of the invited bidders. Substitutions shall not be submitted or noted on the Construction Bid Form.
   2) Substitutions shall be listed by manufacturer catalog number and all other information necessary for comparison and the amount to be DEDUCTED or ADDED to the contract sum shall be stated for each item.
B. Substitution Request Submittal: Requests for substitution will be considered if received within a reasonable time prior to the commencement of the Work as defined by the Construction Manager. This shall be 3 days prior to bid. Requests received after the commencement of the Work may be considered or rejected at the discretion of the Owner’s Representative.
C. Submit a copy of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
D. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
1) Product Data, including Drawings and descriptions of products, fabrication and installation procedures.

2) Samples, where applicable or requested.

3) A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

4) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.

5) A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

6) Cost information, including a proposal of the net change, if any in the Contract Sum.

7) Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.

E. Architect's/Engineer’s Action: Within one day of receipt of the request for substitution, the Architect/Engineer will request additional information or documentation necessary for evaluation of the request. Within two weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect/Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Owner’s Representative when one or more of the following conditions are satisfied, as determined by the Owner’s Representative; otherwise requests will be returned without action except to record noncompliance with these requirements.

1) Extensive revisions to Contract Documents are not required.

2) Proposed changes are in keeping with the general intent of Contract Documents.

3) The request is timely, fully documented and properly submitted.

4) The request is directly related to an "or equal" clause or similar language in the Contract Documents.

5) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

6) The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

7) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect/Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
8) The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

9) The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

10) The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.

B. The Contractor's submittal and Architect's/Engineer’s acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

C. Any piece of equipment, article, product, or fixture furnished as a substitute or equivalent to that specified or indicated shall fit the available space allotted and shall allow adequate space around the item for proper connections of piping, ductwork, electrical, etc., for convenient inspection, servicing and maintenance without causing undue hardship. It shall be the responsibility of the Contractor, and the manufacturer or his representative to check the available space allotted to assure that the proposed item will meet these conditions before submittal for approval.

D. Wiring, connections, circuit protection, sizes and capacity, for equipment or devices that requires electrical power is based on the equipment specified and indicated on drawings. If equipment provided as an equivalent or substitute requires an increase in the wiring, connections, circuit protection, or other installation over that indicated, or specified, or required by the equipment specified or indicated, then it shall be the responsibility of the Contractor to provide all necessary increases at his expense and at no additional costs to the contract.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 016310
SECTION 017000 - CONSTRUCTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. General construction and installation procedures.
2. Correction of defective work.
3. Cleaning during construction.
4. Facility startup.
5. Instruction of the owner's personnel.
6. Project completion procedures.
7. Final extermination.
8. Final cleaning.

1.02 DEFINITIONS

A. Concealed Spaces: Spaces which are not accessible after completion of construction.

B. Damage: Any sort of deterioration whether due to weather, normal wear and tear, accident, or abuse, resulting in soiling, marring, breakage, corrosion, rotting, or impairment of function.

C. Debris: Rubbish, waste materials, litter, volatile wastes, and similar materials, with the exception of surplus materials which are to become the property of the owner.

D. Fire Barriers: Any wall, floor, ceiling, or roof which is indicated as having a fire resistance rating.

E. Operational Elements: Equipment, moving parts, electrical conductors, sound and vibration control materials, waterproofing, vapor retarders, piping, ducts, tanks, and other similar materials and components which convey or retard the passage of liquids, gases, heat, light, persons, animals, or insects or which perform a similar function; not including structural elements.

1. Safety Related Elements: Materials and assemblies whose principal function is the promotion of the safety of the building and its occupants, including fire and smoke barriers, fireproofing, emergency egress doors and windows, guardrails, equipment guards, and other similar construction.

F. Smoke Barriers: Any wall, floor, ceiling, or roof which is indicated as being designed to prevent passage of smoke and gases; may be indicated as "smoke barrier," "smoke partitions," "smoke wall," or similar designation.

G. Spaces Not Normally Occupied: Accessible spaces such as roofs, accessible plenums and shafts, accessible spaces above ceilings, trenches, equipment vaults, manholes, accessible attics, and similar spaces, but not including the interior of duct or concealed spaces.

1.03 SUBMITTALS
A. Field Correction Requests: Submit immediately upon discovery of deviation required; include a detailed description of the problem, recommended changes, and reasons it is not possible to comply with the contract documents.

B. Certificate of Final Extermination.

C. Startup Reports:
   1. Submit within 7 days after startup of item covered by report.
   2. Include a statement that the item has been installed properly and is functioning correctly.
   3. Include the following information:
      a. Item started operation.
      b. Date of startup operation.
      c. Entity performing startup.
      d. Applicable specification section.
      e. Results of startup.
      f. Signature of person performing startup.

D. Demonstration Reports:
   1. Submit within 7 days after each demonstration period.
   2. Include the following information:
      a. Description of equipment or system demonstrated, cross-referenced to the contract documents.
      b. Date of demonstration.
      c. Name and title of person performing demonstration.
      d. Name, title, and signature of person observing demonstration.

E. Instruction Reports:
   1. Submit within 7 days after each instruction period.
   2. Include the following information:
      a. Description of instruction provided, cross-referenced to the contract documents.
      b. Date(s) and duration of instruction.
      c. Names and titles of persons performing instruction.
      d. Names, titles, and signatures of persons receiving instruction.

1.04 QUALITY ASSURANCE

A. Cleaning: Perform cleaning in accordance with the recommendations of the manufacturer or fabricator of the product or system. Use only cleaning materials and tools which are specifically recommended, which are not hazardous to health or property, and which will not damage finishes.

1.05 PROJECT CONDITIONS
A. Take precautions to prevent fires and to facilitate fire-fighting operations.
   1. Keep flammable materials in non-combustible containers; store away from potential fire sources; remove flammable waste regularly.
   2. Keep temporary and permanent fire fighting facilities readily accessible; keep fire fighting routes open.
   3. Do not allow smoking in areas where highly combustible or explosive materials are present.
   4. Carefully supervise the operation of potential fire sources, including heating units.
   5. Conduct welding operations in manner to prevent fire; comply with local regulations.

B. Take precautions to prevent accidents due to physical hazards:
   1. Provide barricades, warning lights, or signs as required to inform personnel and the public of the hazard being protected against.
   2. Safety barricades: Comply with regulations.
   3. Provide temporary walkways where walking surfaces are hazardous.

C. Take care to prevent pollution of air, water, and soil.
   1. Comply with environmental protection regulations.
   2. Limit effluent and rainwater runoff into waterways as required by regulations.
   3. Do not dump contaminants in areas that will result in contamination of waterways.

D. Minimize discharge of effluent and rainwater runoff into sewers.
   1. Control sediment discharge into sewers; filter out construction debris, soil, and contaminants.
   2. Comply with regulations and orders of public utilities regarding use of sewers.
   3. Where disposal of effluent or rainwater by means of sewers is not lawful or is not possible, provide alternative methods of disposal.

E. Prevent erosion due to rainwater runoff.

F. Control windblown dust; prevent erosion to site and nuisance to neighbors.

G. Prevent flooding of excavations, below-grade construction, and adjacent properties due to rainwater runoff.

H. Protect existing property indicated to remain, including:
   1. Plants and trees, as indicated on the drawings and as identified by owner. Erect fencing around drip lines of trees. Areas within the drip lines of trees shall be off limits to construction activities including but not limited to parking and storage of materials.
   2. Existing property, as indicated on the drawings.

I. Do not use tools or equipment which produce harmful levels of noise.

J. Keep the site and adjacent public ways free of hazardous and unsanitary conditions and public nuisances.
K. Control rodents and other pests; prevent infestation of adjacent sites and buildings due to pests on this site.

L. Keep public streets free of debris and material storage due to this work.

M. Provide adequate traffic control by means of signs, signals, and flagmen, as necessary.

N. Provide temporary means of draining roofs where required.

O. Conduct construction operations so that no part of the work and no part of the existing construction is subjected to damaging operations or influences which are in excess of those to be expected during normal occupancy conditions.

P. Conduct construction operations so that waste of power, water, and fuel is avoided.

Q. Provide temporary supports as required to prevent movement and structural failure.

R. Install products only during environmental conditions which will ensure the best possible results.

1.06 SEQUENCING AND SCHEDULING

A. Install products only at the time and in the sequence which will ensure the best possible results.

B. Coordinate required administrative activities with related construction activities.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL EXAMINATION REQUIREMENTS

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
   1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   a. Description of the Work.
   b. List of detrimental conditions, including substrates.
   c. List of unacceptable installation tolerances.
   d. Recommended corrections.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.
6. Conditions which could have been discovered by examination will not be allowed as cause for claims for extra work.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to the local utility and the Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.


3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General:
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
   2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   3. Inform installers of lines and levels to which they must comply.
   4. Check the location, level and plumb, of every major element as the Work progresses.
   5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Verify that utility requirements of operating equipment are compatible with building utilities.

3.04 GENERAL INSTALLATION PROCEDURES

E. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

I. Coordinate exact locations of fixtures and outlets with finish elements.

J. Install work in such manner and sequence as to preclude, if possible, or at least to minimize, cutting and patching.

K. Miscellaneous

1. Do not cut any structural elements
2. Existing Construction:
   a. Perform work in existing construction in same manner as for new construction unless otherwise specified.
   b. Where a new surface exposed to view is an extension of any existing surface, align both surfaces without a change of plane and make a neat transition between finishes.
c. If a change of plane is necessary due to the configuration of the existing surface, obtain instructions from the architect.

d. Where portions of existing work are removed, patch remaining work with neat transitions between remaining surfaces without evidence of cutting.

e. Where neat transitions between remaining surfaces are not possible due to configuration of existing surfaces, obtain instructions from the architect.

f. Where existing construction is removed, remove existing utility services located within or upon the existing construction.

g. Cap cut ends of abandoned piping, conduit, and duct in such a manner that they are concealed in finish work.

3.05 CLEANING AND PROTECTION

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.


2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

3.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

L. Protect installed work from soiling and damage.

M. Protection means and methods
   1. Provide protective coverings as required.
   2. Provide protective coverings for work which may be damaged by subsequent operations.
   3. Where heavy abuse is expected, use minimum of plywood for protection.
   4. Maintain protective coverings until substantial completion.
   5. Comply with manufacturers written instructions for temperature and relative humidity.

3.02 INSTALLATION OF COMPONENTS

A. Install all products in accordance with manufacturer's instructions and recommendations, whether conveyed in writing or not.

B. Mounting Heights: Where mounting heights are not indicated, mount at heights directed by the architect.

C. Separate incompatible materials with suitable materials or spacing.
   1. Prevent cathodic corrosion.

D. Provide all anchors and fasteners required and use methods necessary to securely fasten work.
   1. Allow for thermal expansion and contraction, and for building movement.

E. After installation, adjust operating components to proper operation.

3.03 PROCEDURES FOR CORRECTION OF WORK

A. The following must be replaced (repair is not acceptable):
   1. Damaged surfaces exposed to view which cannot be repaired without visible evidence of repair.
   2. Components which cannot be repaired to proper operating condition.
   3. Chipped and broken glass.
   5. Scratched reflective surfaces.

B. Repair or Replace:
   1. Components which do not operate properly.
   2. Surfaces exposed to view which cannot be cleaned to original condition.
3. Permanent facilities used during construction.
4. Other defective work.

C. Acceptable Repair Methods:
1. Replacing parts.
2. Refinishing.
3. Touching up with matching materials.
4. Proper adjustment of equipment.

D. When it is necessary to deviate from the contract documents in order to accomplish corrective action, submit a supplemental instruction request.

E. Restore permanent facilities used during construction to specified condition.

F. Restore existing facilities used during construction, and existing facilities affected by construction operations, to original condition.

3.04 FACILITY STARTUP

A. Put each item of equipment and each system into full, satisfactory operation.

B. Prior to Startup:
1. Verify that equipment and systems are complete, correctly connected to utilities, and tested. (certification)
   a. Comply with requirements of manufacturer.
2. Inspect and test as required to ensure that work is installed as specified and to determine suitability for energizing.
   3. Provide power and fuel for startup and testing.
   4. Change over from temporary to permanent utility sources.
   5. Re-adjust and lubricate operating components as required to ensure smooth and unhindered operation.
      a. Check drive rotations, belt tension, control sequences, and other features which might cause damage if not properly adjusted.
6. When specified or when required by manufacturer, have manufacturer's representative prepare for startup or supervise such preparation.

C. Notify the architect at least 5 days prior to startup of each item and system.

D. Execute startup under supervision of responsible personnel in accordance with the manufacturer's instructions.

1. When specified or when required by manufacturer, have manufacturer's representative perform startup.

E. After startup, adjust equipment and systems as required for proper operation.

1. Where specified, perform tests or inspections to determine status of operation.

F. Demonstrate the operation and maintenance of equipment and systems to personnel designated by the
1. Have final operating and maintenance data available during demonstration.

**G.** For equipment and systems which have different operation at different seasons, demonstrate operation during subsequent seasons until fully demonstrated.

### 3.5 INSTRUCTION OF THE OWNER'S PERSONNEL

**A.** Instruct personnel designated by the OWNER in the operation and maintenance of equipment and systems, prior to final payment.

1. Explain all modes of operation and types of maintenance required.
2. Demonstrate all functions, including startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown.
3. Review terms of warranties and procedures for obtaining warranty service.
4. Review maintenance agreements and other similar commitments which extend past final completion.
5. Have operating and maintenance data available for use during instruction.
   a. Review contents in detail.
   b. Prepare and insert additional data when need for such becomes apparent during instruction.

**B.** Arrange times and places of instruction with the University.

1. Provide a minimum of 1 hour of instruction for each item of equipment and each system, unless otherwise specified.

**C.** Provide instruction by qualified personnel of the contractor, unless otherwise specified.

**D.** For equipment and systems which have different operation at different seasons, provide instruction during subsequent seasons until all modes of operation have been covered.

### 3.6 FINAL CLEANING

**A.** Remove materials and equipment which are not part of the work and all debris from the site prior to substantial completion.

1. Remove all surplus materials which are to remain property of the contractor; obtain the owner's instructions as to disposition of surplus material remaining on site and deliver, store, or dispose of as directed.
   2. Remove protective coverings.
   3. Remove temporary facilities.

**B.** Dispose of debris in a lawful manner.

1. Do not burn or bury debris on the site.
2. Do not dispose of volatile wastes in storm or sanitary drains.

**C.** Perform final cleaning prior to requesting inspection for substantial completion.
1. Use only professional cleaners.
2. Clean to the level of cleanliness that would be expected by a commercial building owner from a janitorial service.

D. Clean entire project site and grounds.
   1. Clean up landscaped areas.
   2. Broom clean paved areas.
   3. Rake smooth all exposed earth surfaces.
   4. Remove snow and ice from building and site accesses.

E. In spaces to be occupied, remove dirt, stains, and other foreign substances from all accessible surfaces and remove nonpermanent labels.

F. Remove debris from roofs, gutters, downspouts, and roof drains.

G. In spaces not normally occupied, remove debris and surface dust and wipe equipment clean, removing excess lubrication, paint, and other foreign substances.

H. Remove paint and other coatings from permanent labels and from mechanical and electrical equipment nameplates.

I. Leave the project clean and ready for occupancy.

3.7 PROJECT COMPLETION PROCEDURES

A. Complete the work, prior to substantial completion, as required to obtain consent to occupancy from the governing authorities.

B. Arrange for final inspections by governing authorities to be accomplished prior to substantial completion.
   1. Obtain certificate of occupancy.

C. Prepare as built drawings.

D. If temporary locking systems differ from permanent locking systems, change over to permanent systems prior to substantial completion.

E. Final Extermination: Engage a licensed exterminator to make final inspection and rid the project of rodents, insects, and other pests.

END OF SECTION 017000
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer’s standard warranties on products and special warranties.

1) Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

2) General closeout requirements are included in Section "Project Closeout."

3) Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions-3 through 33.

4) Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.2 WARRANTY REQUIREMENTS

A. Contractor's warranty period(s) stated herein shall apply to all goods and services and all work performed by Contractor hereunder. The warranty period(s) stated herein shall commence upon substantial completion of the facility as accepted by the Owner, and shall remain in effect for 24 months.

B. During warranty period(s) stated herein, Contractor guarantees that qualified personnel will be available to provide on-site service within one week or less from the time Owner verbally notifies seller.

C. Contractor warrants that the goods shall be free from defects in design, materials, workmanship, and title, shall be of best quality if no quality is specified and shall conform in all respects to the terms of the Contract (including, without limitation, the terms of any performance guarantees which may be set forth in the material requisition or specification). If it appears at any time during the warranty period, that the goods, or any part thereof, do not conform to these warranties, and Owner so notifies Contractor within a reasonable time after its discovery, Contractor shall thereupon promptly take such action necessary to correct such nonconformity at its sole expense, and, if Contractor fails, refuses, or is unable promptly to correct such nonconformity, Owner may take all necessary corrective action and Contractor shall reimburse Owner for the entire expense of such corrective action. Unless expressly provided to the contrary in the Contract, Contractor's warranty liability shall also extend to all damages caused by the breach of any of the foregoing warranties or guarantees, but such liability shall in no event include consequential damages such as loss of profit or loss of use.

D. Contractor warrants and guarantees that all goods and/or services covered by the Contract will conform to the terms, plans, drawings, samples or other specifications or descriptions furnished or adopted by Owner and to highest professional standards, will be fit and sufficient for the purpose intended, merchantable, of good material, workmanship and quality, and free from defect. Contractor will be liable for costs, losses or damages incurred as a result of any breach of the warranties set forth herein. This warranty is in addition to and shall not exclude any other warranties arising under the terms of the Contract, applicable law or otherwise. Contractor will indemnify and hold Owner harmless for any losses or damages resulting from injury to person or property as a result of any defect or alleged defect in any item furnished hereunder. Such warranties, including warranties prescribed by
law shall run to Owner, its successors, assigns and customers and to users of the goods purchased hereunder as specified above.

E. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

F. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

G. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

H. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1) Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

I. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.3 SUBMITTALS

A. Submit written warranties to the Owner’s Representative prior to the date certified for Substantial Completion. If the Owner’s Representative’s Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner’s Representative.

1) When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner’s Representative within 15 days of completion of that designated portion of the Work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Owner’s Representative for approval prior to final execution.

C. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or the Contractor and subcontractor, supplier or manufacturer. Submit a draft to the Owner through Owner’s Representative for approval prior to final execution.

1) Refer to individual Sections of Divisions-3 through -33 for specific content requirements, and particular requirements for submittal of special warranties.

D. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
E. Submit all warranties and bond via electronic copies only.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

END OF SECTION 017400
1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
   1) Inspection procedures.
   2) Project record document submittal.
   3) Operating and maintenance manual submittal.
   4) Submittal of warranties.
   5) Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions-3 through -33.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

B. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

   1) Advise Owner of pending insurance change-over requirements.
   2) Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
   3) Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
   4) Submit record drawings, maintenance manuals, damage or settlement survey, property survey, and similar final record information.
   5) Deliver tools, spare parts, extra stock, and similar items.
   6) Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.
   7) Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
   8) Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

C. Inspection Procedures: On receipt of a request for inspection, the Owner’s representative will either proceed with inspection or advise the Contractor of unfilled requirements. The Owner’s Representative will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

   1) The Owner’s Representative will repeat inspection when requested and assured that the Work has been substantially completed.
2) Results of the completed inspection will form the basis of requirements for final acceptance.

1.3 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following:

1) Submit the final payment request with releases and supporting documentation not previously submitted and accepted.

2) Include certificates of insurance for products and completed operations where required.

3) Submit an updated final statement, accounting for final additional changes to the Contract Sum.

4) Submit a certified copy of the Owner’s Representative’s final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Owner’s Representative.

5) Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.

6) Submit consent of surety to final payment.

7) Submit a final liquidated damages settlement statement.

8) Submit evidence of final, continuing insurance coverage complying with insurance requirements.

9) List any exceptions to the above in the request.

B. Reinspection Procedure: The Owner’s Representative will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Owner’s Representative.

1) Upon completion of reinspection, the Owner’s Representative will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

2) If necessary, reinspection will be repeated.

1.4 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for Owner’s Representative’s reference during normal working hours.

B. Project Record Documents: Refer requirements set in Section 01330 “Submittal Procedures”.

C. Maintenance Manuals: Refer requirements set in Section Section 01330 “Submittal Procedures”.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

1) Maintenance manuals.

2) Record documents.
3) Spare parts and materials.
4) Tools.
5) Lubricants.
6) Fuels.
7) Identification systems.
8) Control sequences.
9) Cleaning.
10) Warranties and bonds.
11) Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:
   1) Start-up.
   2) Shutdown.
   3) Emergency operations.
   4) Noise and vibration adjustments.
   5) Safety procedures.
   6) Economy and efficiency adjustments.
   7) Effective energy utilization.
SECTION 017821 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for general closeout procedures.
2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of products in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Submit one electronic version of marked-up Record Prints to the Owner prior to Final Completion in PDF format with mark-ups electronically inserted.

B. Record Specifications: Submit one electronic version of Project's Specifications, including addenda and contract modifications in PDF format with mark-ups electronically inserted.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Drawings: Maintain one electronic version in PDF format with mark-ups electronically inserted.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Drawings.

   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an understandable drawing technique.

c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

   a. Added scope of repair work.

   b. Revisions to details shown on Drawings.

   c. Changes made by Change Order or Construction Change Directive.

   d. Details not on the original Contract Drawings.

   e. Field records for variable and concealed conditions.

3. Mark the Record Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

4. Mark Record Drawings with red font and markings. Supplement with other colors to distinguish between changes for different categories of the Work at the same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Newly Prepared Record Drawings: Prepare new Drawings instead of adding marks to existing Record Drawings where Owner determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

   1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

   1. Organize Record Drawings into manageable sets, adding bookmarks to identify separate construction disciplines and each separate sheet.

   2. Identification: As follows:

      a. Project name.

      b. Date.

      c. Designation "PROJECT RECORD DRAWINGS."

      d. Name of Contractor.
2.2 RECORD SPECIFICATIONS

1. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

2. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.

3. Note related Change Orders, Record Drawings, and Product Data where applicable.

2.3 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Assemble into electronic PDF document, bookmarked for each individual specification section and further sub-bookmarked to identify each submittal.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in a minimum of two electronic locations. Provide for automatic electronic backup once every 24 hours. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017821
SECTION 017823 - OPERATION AND MAINTENANCE DATA

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 preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Product maintenance manuals.

1.3 CLOSEOUT SUBMITTALS
A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Owner will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Owner.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.
   2. Two paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS
A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

E. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

2.2 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.
E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a manual that provides an organized reference to operation, and maintenance.

1. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

END OF SECTION 017823
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. Form-facing material for cast-in-place concrete.
   2. Shoring, bracing, and anchoring.

B. Related Requirements:
   1. Section 321313 "Concrete Paving" for formwork related to concrete pavement and walks.

1.3 DEFINITIONS

A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following:
   1. Exposed surface form-facing material.
   2. Concealed surface form-facing material.
   3. Void forms.
   4. Form ties.
   5. Waterstops.
   6. Form-release agent.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspection agency.

B. Field quality-control reports.
1.6 QUALITY ASSURANCE
   A. Testing and Inspection Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING
   A. Form Liners: Store form liners under cover to protect from sunlight.
   B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, and shores in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
      1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
      2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
         a. For architectural concrete specified in Section 033300 "Architectural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

2.2 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.
         b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
            1) APA HDO (high-density overlay).
            2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
            3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
            4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
   B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
1. Provide lumber dressed on at least two edges and one side for tight fit.

C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

D. Flexible Rubber Waterstops: U.S. Army Corps of Engineers CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Profile: Flat dumbbell with center bulb
   2. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.8 mm thick); nontapered.

E. Flexible PVC Waterstops: U.S. Army Corps of Engineers CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Profile: Flat dumbbell with center bulb
   2. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.8 mm thick); nontapered.

F. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

G. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

2.3 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. 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.
   2. Form release agent for form liners shall be acceptable to form liner manufacturer.

F. 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 (25 mm) to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301 (ACI 301M).

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M) 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-1.0: ACI 117 Class D, 1 inch (25 mm).
   2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch (6 mm).
   3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch (3.0 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.
   1. Minimize joints.
   2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
   1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
   2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. 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.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
   1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
   2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches (305 mm).

K. 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.

L. 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.
4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
   a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings
   a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. 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. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
5. Clean embedded items immediate prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 033000 "Cast-In-Place Concrete."
4. Secure waterstops in correct position at 12 inches (305 mm) on center.
5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.
   a. Miter corners, intersections, and directional changes in waterstops.
   b. Align center bulbs.
6. Clean waterstops immediately prior to placement of concrete.
7. Support and protect exposed waterstops during progress of the Work.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Protect exposed waterstops during progress of the Work.

3.4 REMOVING AND REUSING FORMS
A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
B. Clean and repair surfaces of forms to be reused in the Work.
   1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
   1. Align and secure joints to avoid offsets.
   2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.5 SHORING INSTALLATION
A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring.
   1. Do not remove shoring until measurement of slab tolerances is complete.
B. Plan sequence of removal of shores to avoid damage to concrete.
3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
   1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000
SECTION 032000 - CONCRETE REINFORCING

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 reinforcement bars.
2. Welded-wire reinforcement.

B. Related Requirements:

1. Section 034100 "Precast Structural Concrete" for reinforcing used in precast structural concrete.
2. Section 034500 "Precast Architectural Concrete" for reinforcing used in precast architectural concrete.
3. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.
3. Mechanical splice couplers.

B. 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.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.
PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT
   A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
   B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
   C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
   D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES
   A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
   B. 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.
   C. Mechanical Splice Couplers: ACI 318 (ACI 318M), same material of reinforcing bar being spliced.
   D. Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) 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 (25 mm), 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 (ACI 318M).

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

G. Install welded-wire reinforcement in longest practicable lengths.
      a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches (305 mm).
   2. Lap edges and ends of adjoining sheets at least one mesh spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) 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. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel-reinforcement placement.
2. Steel-reinforcement mechanical splice couplers.
3. Steel-reinforcement welding.

END OF SECTION 032000
SECTION 033000 - CAST-IN-PLACE CONCRETE

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. 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.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:

   a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
5. Vapor retarders.
6. Floor and slab treatments.
7. Liquid floor treatments.
8. Curing materials.

   a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.

B. 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.
   10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. 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.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
   1. Concrete Class designation.
   2. Location within Project.
   3. Exposure Class designation.
   4. Formed Surface Finish designation and final finish.
   5. Final finish for floors.
   6. Curing process.
   7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:
   1. Installer: Include copies of applicable ACI certificates.
   2. Ready-mixed concrete manufacturer.
   3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Curing compounds.
   4. Floor and slab treatments.
   5. Bonding agents.
   6. Adhesives.
   7. Vapor retarders.
   8. Semirigid joint filler.

C. Material Test Reports: For the following, from a qualified testing agency:
   1. Portland cement.
   2. Fly ash.
   3. Aggregates.
   4. Admixtures.

D. Preconstruction Test Reports: For each mix design.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE
A. Installer Qualifications: A qualified installer who employs Project personnel qualified as a ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician
   1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated, and employing an ACI-certified Concrete Quality Control Technical Manager.
   1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Field Quality Control Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.8 FIELD CONDITIONS
A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1 and as follows.
1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F (1.7 deg C), other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

**B. Hot-Weather Placement:** Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F (35 deg C).
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

**PART 2 - PRODUCTS**

### 2.1 CONCRETE, GENERAL

**A. ACI Publications:** Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).

### 2.2 CONCRETE MATERIALS

**A. Source Limitations:**

1. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
2. Obtain aggregate from single source.
3. Obtain each type of admixture from single source from single manufacturer.

**B. Cementitious Materials:**

2. Fly Ash: ASTM C618, Class C or F.

**C. Normal-Weight Aggregates:** ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:
   a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
   b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
   c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293.
and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).


D. Air-Entraining Admixture: ASTM C260/C260M.

E. 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. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, portable

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils (0.25 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.


1. Color:
   a. Ambient Temperature Below 50 deg F (10 deg C): Black.
   b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
   c. Ambient Temperature Above 85 deg F (29 deg C): White.

D. Curing Paper: Eight-feet- (2438-mm-) wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

E. Water: Potable or complying with ASTM C1602/C1602M.
F. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

G. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.

H. Clear, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

I. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

J. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.6 RELATED MATERIALS


B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Floor Slab Protective Covering: Eight-feet- (2438-mm-) wide cellulose fabric.

2.7 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3 mm) and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand, as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested in accordance with ASTM C109/C109M.
2.8 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 (ACI 301M).

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Total of Fly Ash or Other Pozzolans, and Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, and concrete with a w/cm below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
5. Use permeability-reducing admixture in concrete mixtures where indicated.

D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.9 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings, grade beams, and foundation walls.

1. Exposure Class: ACI 318 (ACI 318M) F2 S1 C1.
2. Minimum Compressive Strength: 4500 psi (31 MPa) at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture.
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 (19-mm) nominal maximum aggregate size; 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size; 5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size.
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

B. Class B: Normal-weight concrete used for interior slabs-on-ground.
1. Exposure Class: ACI 318 (ACI 318M).
2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture.
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.
6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

C. Class C: Normal-weight concrete used for interior concrete toppings on metal deck.

1. Exposure Class: ACI 318 (ACI 318M).
2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
3. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture.
4. 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.
5. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

D. Class D: Normal-weight concrete used for interior building walls.

1. Exposure Class: ACI 318 (ACI 318M).
2. Minimum Compressive Strength: 4500 psi (31 MPa) at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture.
5. Air Content:
   a. Do not use air entraining admixture, or allow total air content to exceed 3 percent
6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

E. Class I: Normal-weight concrete used for interior metal pan stairs and landings:

1. Exposure Class: ACI 318 (ACI 318M).
2. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
3. Maximum w/cm: 0.53.
5. Maximum Size Aggregate: 1/2 inch (13 mm).
6. Slump Limit: 3 inches (75 mm), plus 1 inch (25 mm) or minus 2 inches (50 mm).
7. Air Content: 0 percent, plus or minus 0.5 percent at point of delivery.
8. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
10. Accelerating Admixture: Not allowed.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.

2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.

2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.3 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 (150 mm), sealing vapor retarder to concrete.
4. Lap joints 6 inches (150 mm) 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 (150 mm) on all sides, and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.4 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 (38 mm) into concrete.
   4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
   7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth 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 (3.2 mm). 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- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.

2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.5 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 (ACI 301M), 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 (ACI 301M).

   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 (150 mm) 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.
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.

3.6 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
   
   a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
   b. Remove projections larger than 1 inch (25 mm).
   c. Tie holes do not require patching.
   d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
   e. Apply to concrete surfaces not exposed to public view

2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

   a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
   b. Remove projections larger than 1/4 inch (6 mm).
   c. Patch tie holes.
   d. Surface Tolerance: ACI 117 (ACI 117M) Class B.
   e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

3. ACI 301 (ACI 301M) Surface Finish SF-3.0:

   a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
   b. Remove projections larger than 1/8 inch (3 mm).
   c. Patch tie holes.
   d. Surface Tolerance: ACI 117 (ACI 117M) Class A.
   e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
3.7 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:
   1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
   2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch (6 mm) in one direction.
   3. Apply scratch finish to surfaces to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:
   1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
   2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
   3. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish:
   1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
   2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
   3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   4. Do not add water to concrete surface.
   5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
   6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm).

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.

3.8 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 (100 mm) high unless otherwise indicated on Drawings, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
   3. Minimum Compressive Strength: 5000 psi (34.5 MPa) at 28 days.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
   5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
   6. Prior to pouring concrete, place and secure anchorage devices.
      a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
      b. Cast anchor-bolt insert into bases.
      c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
   1. Cast-in inserts and accessories, as shown on Drawings.
   2. Screed, tamp, and trowel finish concrete surfaces.

3.9 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
   1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
   2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply in accordance with manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
   1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
   2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
   3. If forms remain during curing period, moist cure after loosening forms.
   4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
      a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
      b. Continuous Sprinkling: Maintain concrete surface continuously wet.
c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.

d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.

e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

D. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) 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 (300-mm).
   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 (300 mm), and sealed by waterproof tape or adhesive.

   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

   a) Water.
   b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

   a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
   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 (300 mm), 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.

c) Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

d) Floors to Receive 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.

e) 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.

3.10 TOLERANCES

A. Conform to ACI 117 (ACI 117M).

B. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s).
2. Do not fill joints until construction traffic has permanently ceased.

C. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

D. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints.

E. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.11 CONCRETE SURFACE REPAIRS

A. Defective Concrete:
   1. Repair and patch defective areas when approved by Architect.
   2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spills, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete.
      a. Limit cut depth to 3/4 inch (19 mm).
      b. Make edges of cuts perpendicular to concrete surface.
      c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
      d. Fill and compact with patching mortar before bonding agent has dried.
      e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
      a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
      b. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:
   1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
      a. Correct low and high areas.
      b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   2. Repair finished surfaces containing surface defects, including spills, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to
reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

3. After concrete has cured at least 14 days, correct high areas by grinding.

4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
   a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
   a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.
   a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations.
   b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete.
   a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around.
   b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
   c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
   d. Place, compact, and finish to blend with adjacent finished concrete.
   e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar.
   a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
   b. Dampen cleaned concrete surfaces and apply bonding agent.
   c. Place patching mortar before bonding agent has dried.
   d. Compact patching mortar and finish to match adjacent concrete.
   e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.12 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
1. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.

2. 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 and ASTM C39/C39M, including the following as applicable to each test and inspection:

      1) Project name.
      2) Name of testing agency.
      3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
      4) Name of concrete manufacturer.
      5) Date and time of inspection, sampling, and field testing.
      6) Date and time of concrete placement.
      7) Location in Work of concrete represented by samples.
      8) Date and time sample was obtained.
      9) Truck and batch ticket numbers.
     10) Design compressive strength at 28 days.
     11) Concrete mixture designation, proportions, and materials.
     12) Field test results.
     13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
     14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

   1. Headed bolts and studs.
   2. Verification of use of required design mixture.
   3. Concrete placement, including conveying and depositing.
   4. Curing procedures and maintenance of curing temperature.
   5. Verification of concrete strength before removal of shores and forms from beams and slabs.

E. 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. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) 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 (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31/C31M:
   a. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

   a. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

8. 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 (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive-strength test value is less than 1 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).

9. 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.

10. 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 (ACI 301M), section 1.6.6.3.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.13 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000
SECTION 051200 - STRUCTURAL STEEL FRAMING

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.
2. Prefabricated building columns.
3. Shear stud connectors.
4. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
3. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame [miscellaneous steel fabrications and other steel items not defined as structural steel.
4. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" [and] Section 099600 "High-Performance Coatings" for painting requirements.
5. Section 133419 "Metal Building Systems" for structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site
1.6 ACTION SUBMITTALS

A. Product Data:

2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Forged-steel hardware.
7. Slide bearings.
8. Prefabricated building columns.
11. Etching cleaner.
13. Shrinkage-resistant grout.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for EPDs and HPDs.>

C. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand-critical welds.
8. Identify members not to be shop primed.

D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

E. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, 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. Mill test reports for structural-steel materials, including chemical and physical properties.

E. Product Test Reports: For the following:
   1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
   2. Direct-tension indicators.
   3. Tension-control, high-strength, bolt-nut-washer assemblies.
   4. Shear stud connectors.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control reports.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
   1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.
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 341.
3. ANSI/AISC 360.

B. Connection Design Information:

1. Option 3 and 3A: Design connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer. Member reinforcement at connections is indicated on Drawings.
   a. Use Load and Resistance Factor Design; data are given at factored-load level

C. Moment Connections: Designed by project engineer and shown on drawings.

D. Construction: Combined system of moment frame and shear walls

2.2 STRUCTURAL-STEEL MATERIALS

A. <Double click to insert sustainable design text for recycled content.>

B. W-Shapes: ASTM A992/A992M

C. Channels, Angles-Shapes: ASTM A36/A36M

D. Plate and Bar: ASTM A36/A36M

E. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
   1. Finish: Plain

C. 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
   5. Finish: [Plain] [Hot-dip zinc coating, ASTM A153/A153M, Class C] [Mechanically deposited zinc coating, ASTM B695, Class 50].

B. Headed Anchor Rods: [ASTM F1554, Grade 36] [ASTM F1554, Grade 55, weldable] [ASTM A354] [ASTM A449], straight.
   3. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
   4. Finish: [Plain] [Hot-dip zinc coating, ASTM A153/A153M, Class C] [Mechanically deposited zinc coating, ASTM B695, Class 50].

C. Threaded Rods: [ASTM A36/A36M] [ASTM A193/A193M, Grade B7] [ASTM A354, Grade BD] [ASTM A449] [ASTM A572/A572M, Grade 50 (Grade 345)].
   2. Washers: [ASTM F436 (ASTM F436M), Type 1, hardened] [ASTM A36/A36M] carbon steel.
   3. Finish: [Plain] [Hot-dip zinc coating, ASTM A153/A153M, Class C] [Mechanically deposited zinc coating, ASTM B695, Class 50].

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. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. 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.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.

F. 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.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

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.
   1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
   1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels attached to structural-steel frame and located in exterior walls.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces
7. Surfaces enclosed in interior construction.

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 2.

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner

D. 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 (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
   a. Liquid Penetrant Inspection: ASTM E165/E165M.
   b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
   c. Ultrasonic Inspection: ASTM E164.
   d. Radiographic Inspection: ASTM E94/E94M.
4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
   a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
   b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
5. Prepare test and inspection reports.
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.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.


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.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.
F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 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.

2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
   a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      1) Liquid Penetrant Inspection: ASTM E165/E165M.
      2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      3) Ultrasonic Inspection: ASTM E164.
      4) Radiographic Inspection: ASTM E94/E94M.

3.6 PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting”
SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Load-bearing wall framing.
   2. Exterior non-load-bearing wall framing.
   4. Floor joist framing.
   5. Ceiling joist framing.

B. Related Requirements:
   1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
   2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
   3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.
1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency or a by a qualified testing agency.
   1. Steel sheet.
   2. Expansion anchors.
   4. Mechanical fasteners.
   5. Vertical deflection clips.
   6. Horizontal drift deflection clips
   7. Miscellaneous structural clips and accessories.

E. Evaluation Reports: For nonstandard cold-formed steel framing, post-installed anchors, and power-actuated fasteners from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. 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.

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

E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a service level horizontal load of 5 lbf/sq. ft. (239 Pa).
   b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
   c. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a service level horizontal load of 5 lbf/sq. ft. (239 Pa).
   d. Floor Joist Framing: Vertical deflection of 1/480 for live loads and 1/240 for total loads of the span.
   e. Ceiling Joist Framing: Vertical deflection of 1/240 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of 3/4 inch (19 mm).

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

2. Wall Studs: AISI S211.
3. Headers: AISI S212.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90).

B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
2. Coating: G60 (Z180).

2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows

D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure.

2. Inner Track: Of web depth indicated.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges.
C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FLOOR JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
   2. Flange Width: As required for design
   3. Section Properties: As required for design

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
   2. Flange Width: As required for design.

2.7 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths as required, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
   2. Flange Width: As required for design.
   3. Section Properties: As required for design

2.8 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
   2. Flange Width: 1-5/8 inches (41 mm), minimum.
   3. Section Properties: As required for design
2.9 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
9. Joist hangers and end closures.

2.10 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor, Torque-controlled adhesive anchor, or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.
2.11 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B or SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.12 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing 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 PREPARATION

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

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

   b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch (3 mm) between the end of wall-framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.

3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.

2. Install double deep-leg deflection tracks and anchor outer track to building structure.

3. Connect vertical deflection clips to bypassing studs and anchor to building structure.

4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.7 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
   1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
   2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
   1. Joist Spacing: 16 inches (406 mm).

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
   1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
   1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
   2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.8 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.9 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000
SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes the following:
      1. Wood blocking and nailers.
      2. Wood furring and grounds.
      3. Plywood backing panels.
      4. Concealed wood blocking for support of light fixtures, heaters, and other surface mounted accessories.

   B. Related Sections include the following:

1.3 DEFINITIONS
   A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

   B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
      2. NLGA: National Lumber Grades Authority.
      3. WCLIB: West Coast Lumber Inspection Bureau.
      4. WWPA: Western Wood Products Association.

1.4 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. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
      3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

   B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
      1. Wood-preservative-treated wood.
      2. Power-driven fasteners.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of 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. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2.

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 cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

D. Application: Treat items indicated on Drawings, and the following:
   1. Concealed blocking.
   2. Roof construction.
   3. Plywood backing panels.

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. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content and any of the following species:
   1. Southern pine, fir.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
   1. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 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. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, 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 rough 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 A 153/A 153M or of Type 304 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Do not splice structural members between supports, unless otherwise indicated.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

E. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

F. Sort and select lumber so that natural characteristics will 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. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

5. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
6. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.

I. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and/or vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

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 rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1000
SECTION 07 6100 - SHEET METAL ROOFING

GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following custom-fabricated sheet metal roofing:

1. Standing-seam metal roofing.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide complete sheet metal roofing system, including, but not limited to, custom-fabricated metal roof pans, cleats, clips, anchors and fasteners, sheet metal flashing and drainage components related to sheet metal roofing, fascia panels, trim, underlayment, and accessories as indicated and as required for a weathertight installation.

B. Wind-Uplift Resistance: Provide custom-fabricated sheet metal roofing capable of meeting the following tests: UL 90 Uplift, ASTM 1592 Uplift. Provide clips, fasteners, and clip spacings of type indicated and with capability to sustain, without failure, the requirements of the tests indicated.

C. Thermal Movements: Provide sheet metal roofing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal roofing thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Water Infiltration: Provide sheet metal roofing that does not allow water infiltration to building interior, with metal flashing and connections of sheet metal roofing lapped to allow moisture to run over and off the material.

1.4 SUBMITTALS

A. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, and keyed references to termination points. Distinguish between shop- and field-assembled work. Include the following:

1. Details for forming sheet metal roofing, including seams and dimensions.
2. Details for joining and securing sheet metal roofing, including layout of fasteners, clips, and other attachments. Include pattern of seams.
3. Details of termination points and assemblies, including fixed points.
4. Details of expansion joints, including showing direction of expansion and contraction.
5. Details of roof penetrations.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Details of the following accessory items, at a scale of not less than 1-1/2 inches per 12 inches:
   a. Flashing and trim.
   b. Snow Guards

B. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:
   1. Sheet metal roofing and attachments.
   2. Purlins and rafters.
   3. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.

C. Samples for Initial Selection: For each type of sheet metal roofing indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Sheet Metal Roofing: 12 inches (300 mm) long by actual pan width, including finished seam. Include fasteners, cleats, clips, closures, and other attachments.
   2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
   3. Accessories: 12 inch (300 mm) long Samples for each type of accessory.

E. Qualification Data: For Installer

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sheet metal roofing portable roll-forming equipment. Include reports for structural performance.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of sheet metal roofing.

B. Custom-Fabricated Sheet Metal Roofing Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate sheet metal roofing similar to that required for this Project and whose products have a record of successful in-service performance.

C. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to sheet metal roofing including, but not limited to, the following:
1. Meet with Owner, Architect, Engineer, manufacturer's representative for sheet metal roofing installer, and installers whose work interfaces with or affects sheet metal roofing including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to sheet metal roofing installation.
4. Examine sheathing conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of sheathing during and after roofing.
6. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal roofing.
7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
8. Review temporary protection requirements for sheet metal roofing during and after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal roofing pans, components, and other sheet metal roofing materials so as not to be damaged or deformed. Package sheet metal roofing materials for protection during transportation and handling.

B. Unload, store, and erect sheet metal roofing materials in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Store sheet metal roofing materials to ensure dryness. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store aluminum and copper away from uncured concrete and masonry.

D. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.

1.7 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Division 7 Section “Roof Accessories.”

B. Coordinate sheet metal roofing with rain drainage work, flashing, trim, and construction of parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Installer's Warranty: Roofing Installer's warranty, on warranty form at end of this Section, signed by Roofing Installer, in which Roofing Installer agrees to repair or replace components of custom-fabricated sheet metal roofing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Loose parts.
   c. Wrinkling or buckling.
   d. Failure to remain weathertight, including uncontrolled water leakage.
   e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
   f. Galvanic action between sheet metal roofing and dissimilar materials.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for the standing seam roof is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product:

1. McElroy "Maxima" standing seam roof system with 2" x 18" flat pans

2.2 ROOF PANEL MATERIALS

A. Profile: Vertical Leg standing seam panel with Male/Female seams to be mechanically interlocked at the jobsite with a mechanical seamer specifically designed for the specified panel.

B. Size: 2" High seam by 18" width. Length as indicated on drawings

C. Panel surface: Flat pan with a smooth, flat finish.

D. Material: Galvalume steel sheet conforming to ASTM A792, AZ55 coating, 24 gauge sheet thickness

1. Exposed finishes: Apply the following coil coating, as specified or indicated on Drawings:

   a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605.

      2) Color: As selected by Architect from manufacturer's full range.
2.3 UNDERLAYMENT MATERIALS

A. Ice and Water Shield

B. Slip Sheet: Building paper, minimum 5 lb/100 sq. ft., and rosin sized.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

B. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   1. Exposed Fasteners: Heads matching color of sheet metal roofing by means of plastic caps or factory-applied coating.
   2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.

C. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to produce joints in sheet metal roofing that will remain weathertight and as recommended by roll-formed sheet metal roofing manufacturer for installation indicated.

D. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4 mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 ACCESSORIES

A. Sheet Metal Roofing Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of sheet metal roofing, unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as sheet metal roofing.
   2. Clips: Minimum 0.0625-inch (1.6-mm) thick, stainless-steel panel clips designed to withstand negative-load requirements.
   3. Cleats: Mechanically seamed cleats formed from the following material:
      a. Copper Roofing: 16-oz./sq. ft. (0.55-mm) thick copper sheet.
      b. Metallic-Coated Steel Roofing: 0.0250-inch (0.65-mm) thick, stainless-steel or nylon-coated aluminum sheet.
   4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   5. Closures: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch (25-mm) thick, flexible closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.0179-inch (0.45-mm) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. 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. Finish flashing and trim with same finish system as adjacent sheet metal roofing.
C. Gutters: Formed from 0.0179-inch (0.45-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch (2400-mm-) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 36 inches (900 mm) o.c., fabricated from same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at outlets. Finish gutters to match roof fascia and rake trim.

D. Downspouts: Formed from 0.0179-inch (0.45-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; in 10-foot (3-m-) long sections, complete with formed elbows and offsets. Finish downspouts to match sheet metal gutters.

E. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

F. Snow Guards: Prefabricated, noncorrosive units designed to be installed without penetrating sheet metal roofing, and complete with predrilled holes, clamps, or hooks for anchoring.
   1. Seam-Mounted, Bar-Type Snow Guards: Aluminum bars held in place by stainless-steel clamps attached to vertical ribs of standing-seam sheet metal roofing.
      a. Aluminum Finish: Clear anodized, Color bar to match roofing
      b. Available Products:
         1) Alpine Snow Guards, SnowMax Bar system
         2) Riddell & Company, Inc.; Snobar Colorbar to match roof
         3) Approved Equal

2.6 FABRICATION

A. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.
   1. Standing-Seam Roofing: Form standing-seam pans with finished seam height of 2 inch (50 mm).

B. Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.
   1. Lay out sheet metal roofing so cross seams, when required, are made in direction of flow with higher pans overlapping lower pans. Stagger cross seams.
   2. Fold and cleat eaves and transverse seams in the shop.
   3. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown and as required for leakproof construction.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant (concealed within joints).

D. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to
each contact surface, or by other permanent separation as recommended by manufacturers of dissimilar metals or by fabricator.

F. **Sheet Metal Accessories:** Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

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.
2. **Seams for Aluminum:** Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. **Seams for Other Than Aluminum:** Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. **Sealed Joints:** Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   a. **Size:** As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.7 **FINISHES, GENERAL**

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted 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.

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**PART 3 - EXECUTION**

3.1 **EXAMINATION**

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, sheet metal roofing supports, and other conditions affecting performance of work.
   1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for flashings, and penetrations through sheet metal roofing.

B. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before sheet metal roofing installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Lay out and screw wood battens to metal deck before installation of sheet metal roofing. Space fasteners as required to resist design uplift, but not more than 18 inches (457 mm) o.c.

B. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

C. Install fasciae and copings to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

3.3 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment and building-paper slip sheet on roof sheathing under sheet metal roofing. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under sheet metal roofing. Apply at locations indicated, in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

1. Apply from eave to ridge.

B. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

C. Apply slip sheet over underlayment before installing sheet metal roofing.

3.4 INSTALLATION, GENERAL

A. General: Install sheet metal roofing perpendicular to purlins or supports. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

1. Field cutting of sheet metal roofing by torch is not permitted.

2. Rigidly fasten eave end of sheet metal roofing and allow ridge end free movement due to thermal expansion and contraction. Predrill roofing.

3. Provide metal closures at peaks, rake edges, rake walls, and each side of ridge and hip caps.

4. Flash and seal sheet metal roofing with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.

5. Locate and space fastenings in uniform vertical and horizontal alignment.

6. Install ridge and hip caps as sheet metal roofing work proceeds.

7. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition.

8. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.

B. Fasteners: Use fasteners of sizes that will not penetrate completely through substrate.

1. Steel Roofing: Use stainless-steel fasteners.

2. Aluminum Roofing: Use aluminum or stainless-steel fasteners.

3. Copper Roofing: Use copper, hardware bronze, or stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of dissimilar metals.

1. Coat back side of sheet metal roofing with bituminous coating where roofing will contact wood, ferrous metal, or cementitious construction.

D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

E. Fascia: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.5 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION

A. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges, unless otherwise indicated.

1. Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
2. Nail cleats not more than 12 inches (300 mm) o.c. Bend tabs over nails.

B. Seal joints as shown and as required for leakproof construction. Provide low-slope transverse seams using cleats where backup of moisture may occur.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

C. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pretinned surface would show in finished Work.

1. Do not solder metallic-coated steel sheet.
2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

D. Provide expansion cleats in roof panels that exceed 30 feet (9.1 m) in length.

E. Standing-Seam Roofing: Attach standing-seam metal pans to substrate with cleats, double-nailed at 12 inches (305 mm) o.c. Install pans reaching from eave to ridge before moving to adjacent pans. Lock each pan to pan below with transverse seam. Before pans are locked, apply continuous bead of sealant to top flange of lower pan. Crimp standing seams by folding over twice so cleat and pan edges are completely engaged.

1. Loose-lock pans at eave edges to continuous cleats and flanges on back edges of gutters.
2. Fold over seams after crimping at ridges and hips.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weatherlight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete sheet metal roofing assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

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 as indicated. 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 (3 m) with no joints allowed within 24 inches (600 mm) 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 (25 mm) 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 not more than 4 feet (1.2 m) o.c. 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 (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.

1. Provide elbows at base of downspout to direct water away from building.

E. Bar-Type Snow Guards: Attach bar supports to vertical ribs of standing-seam sheet metal roofing with clamps or set screws. Do not use fasteners that will penetrate sheet metal roofing.

1. Provide one row of snow guards, at locations indicated on Drawings, beginning 12" up from gutter (verify with existing roof dimension and match accordingly).

F. Pipe Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended by manufacturer.

3.7 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder and sealants.

B. Remove temporary protective coverings and strippable films, if any, as sheet metal roofing is installed. On completion of sheet metal roofing installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
C. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 6100
SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Manufactured through-wall flashing.
2. Formed roof drainage system.
3. Formed steep-slope roof flashing and trim.
4. Formed wall flashing and trim.
5. Formed equipment support flashing.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.
1.5 **QUALITY ASSURANCE**

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1. Copper Standard: Comply with CDA's "Copper in Architecture Handbook."

1.6 **DELIVERY, STORAGE, AND HANDLING**

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 **COORDINATION**

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

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**PART 2 - PRODUCTS**

2.1 **MANUFACTURERS**

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

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

2.2 **SHEET METALS**

A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.

B. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).

1. Product: Subject to compliance with requirements, provide "TCS II" by Follansbee Steel.

C. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality, not less than 0.0336 inch thick, unless otherwise indicated.

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2.3 **MISCELLANEOUS MATERIALS**
A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Nails for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch minimum and not less than 7/8 inch long, barbed with large head.
2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

E. Solder for Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.

F. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

G. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

I. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seams, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   1. Thickness: As recommended by SMACNA’s “Architectural Sheet Metal Manual” for application but not less than thickness of metal being secured.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
   1. Expansion Joints: Lap type.
   2. Accessories: Valley baffles.
   3. Gutters with Girth up to 15 Inches: Fabricate from the following material:
      a. Galvanized Steel: 0.0217 inch thick.

B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Manufactured Hanger Style: <Insert description.>
   2. Fabricate downspouts from the following material:
      a. Galvanized Steel: 0.0217 inch thick.

2.6 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high end dams. Fabricate from the following material:
   1. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch thick.

B. Openings Flashing in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high end dams. Fabricate from the following material:
   1. Galvanized Steel: 0.0217 inch thick.

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following material:
   1. Galvanized Steel: 0.0217 inch thick.
B. Valley Flashing: Fabricate from the following material:
   1. Prepainted, Metallic-Coated Steel: 0.0276 inch (0.7 mm).

C. Drip Edges: Fabricate from the following material:
   1. Galvanized Steel: 0.0217 inch thick.

D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following material:
   1. Galvanized Steel: 0.0217 inch thick.

E. Base Flashing: Fabricate from the following material:
   1. Galvanized Steel: 0.0276 inch thick.

F. Counterflashing: Fabricate from the following material:
   1. Galvanized Steel: 0.0217 inch thick.

G. Flashing Receivers: Fabricate from the following material:
   1. Galvanized Steel: 0.0217 inch thick.

H. Roof-Penetration Flashing: Fabricate from the following material:
   1. Galvanized Steel: 0.0276 inch thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:
   1. Galvanized Steel: 0.0276 inch thick.

2.9 FINISHES

A. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

B. Protect mechanical and painted 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 substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. 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 watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Copper: Use copper, hardware bronze, or stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Pretinning is not required for zinc-tin alloy-coated stainless steel.
2. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
3. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
4. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Loosely lock straps to front gutter bead and anchor to roof deck.
3. Anchor and loosely lock back edge of gutter to continuous cleat or eave flashing.
4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
5. Anchor gutter with spikes and ferrules spaced not more than 30 inches apart.
6. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.

C. 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 o.c. in between.

1. Provide elbows at base of downspout to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners,
metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 6200
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Preparation and priming of surfaces scheduled at end of this Section to receive finish painting.

1. Finish Painting of Exterior Items and Surfaces, Including:
   a. Exposed exterior surfaces as indicated on drawings.
   b. Exposed steel members and metal deck
   c. Scheduled and otherwise identified exterior surfaces.

2. Exterior Items and Surfaces Not Requiring Painting, Unless Noted Otherwise:
   a. Surfaces coated by other specification sections.
   b. Items with factory applied finishes.
   c. Aluminum, stainless steel, brass, bronze, chromium plate, copper, and nickel.
   d. Moving parts of operating units.
   e. Code required labels or equipment identification plates.

3. Field finish coating of shop or factory primed items. Refer to individual Sections for priming requirements.

4. Finish coatings schedule.

5. Preparation work and coatings specified in this Section are in addition to shop and factory applied finishes and surface treatment specified in other Sections.

6. Refer to Divisions 15 and 16 for painting requirements for items in dedicated mechanical and electrical spaces.

7. Paint all other items unless specifically indicated not to be painted.

B. Related Sections:

1. Division 15 - Mechanical: Mechanical Identification.
2. Division 16 - Electrical: Electrical Identification.

1.2 DEFINITIONS

A. Conform to PDCA Glossary for interpretation of terms used in this Section except as modified below.

1. Exposed Surfaces: Surfaces of products, assemblies, and components visible from any angle after final installation. Includes internal surfaces visible when operable doors, panels or drawers are open, and surfaces visible behind registers, grilles, or louvers.

2. Concealed Surfaces: Surfaces permanently hidden from view in finished construction and which are only visible after removal or disassembly of part or all of product or assembly.


4. Spaces listed below are defined as Concealed or Inaccessible:
   a. Space between suspended ceilings and floor or roof construction above.
   b. Inside furred spaces.
   c. Inside of partitions.
   d. Mechanical and electrical items enclosed within casework or equipment.
   e. Foundation spaces.
   f. Crawl spaces.
   g. Trenches and manholes.
   h. Mechanical shafts or chases.
   i. Enclosed elevator shafts.
5. **Sheen:** Degree of luster as measured with specular gloss meter, ASTM D523:

<table>
<thead>
<tr>
<th>Type</th>
<th>Meter Degree</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat</td>
<td>85</td>
<td>Below 15</td>
</tr>
<tr>
<td>Eggshell</td>
<td>60</td>
<td>5 to 20</td>
</tr>
<tr>
<td>Satin</td>
<td>60</td>
<td>15 to 35</td>
</tr>
<tr>
<td>Semi-gloss</td>
<td>60</td>
<td>30 to 65</td>
</tr>
<tr>
<td>Gloss</td>
<td>60</td>
<td>65 to 80</td>
</tr>
<tr>
<td>High Gloss</td>
<td>60</td>
<td>Over 80</td>
</tr>
</tbody>
</table>

6. **Architectural Paint:** Paints, field applied to stationary structures and their appurtenances, mobile homes, pavements, or curbs.

7. **Industrial Maintenance Primers and Topcoats:** High performance paints formulated for and applied to substrates in industrial, commercial, or institutional situations for purpose resisting heavy abrasion, immersion, prolonged exposure to temperatures in excess of 250 F, prolonged moisture condensation, chemical corrosion, solvent cleaning, or exterior exposure of metal structures.

8. **Metallic Pigmented Paints:** Paints containing at least 0.4 pounds of metallic pigment per gallon of paint as applied.

9. **System DFT:** Dry film thickness of entire paint system unless otherwise noted.

1.3 **System Description**

A. Perform testing according to following methods:

1. **Solids Content by Volume:** ASTM D2832.
2. **Surface Burning Characteristics:** ASTM E84.

B. Application Requirements: Apply scheduled paints to exposed surfaces of items and spaces unless specifically indicated otherwise.

C. Surfaces Not To Be Painted:

1. Architectural concrete.
2. Clay and glass unit masonry, decorative concrete unit masonry, and stone.
3. Aluminum and aluminum based alloys, copper and copper based alloys, lead and lead based alloys, nickel and nickel based alloys, stainless steel, plated architectural metals, and "weathering" metals.
4. Decorative plastic and metal laminates, and synthetic countertops.
5. Elastomeric membranes and flashings, roofing materials, and exterior joint sealants.
6. Acoustic materials.
7. Rubber, vinyl, or plastic seals and bumpers.
8. Surfaces concealed or inaccessible in finished construction unless specifically required.
9. Other surfaces specifically scheduled or indicated to remain unfinished or unpainted.

D. Materials and Products Not To Be Painted:

1. Items with integral or factory-applied final finish unless indicated otherwise.
2. Wire fencing and areaway grating.
3. Cast metal stair nosings, trench drain grates, manhole covers, and curb inlets.
4. Wire mesh partitions and gates, and storage shelving.
5. Moving parts of operating equipment such as valve and damper operators, linkages, sensing devices, motor and fan shafts.
6. UL, FM or other code-required labels, name plates, identification or performance rating labels.
7. Sprinkler heads.
8. Mechanical and electrical items within unfinished spaces unless noted otherwise.
Interface with Adjacent Systems: Review other Sections specifying prime coats to ensure compatibility of total paint system for various substrates.

1. Upon request from other trades, furnish information on characteristics of finish materials proposed for use to ensure compatibility of various paints.
2. Test compatibility of existing coatings, including shop applied primers and previously applied coatings, by applying specified special paint to small, inconspicuous area.
3. If specified paint lifts or blisters existing coating, apply barrier or tie coat as recommended by paint manufacturer.
4. If no compatible barrier or tie coat exists, remove existing coating completely and apply paint system as specified for new work.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 1.

B. Product Data: Submit product data, including label analysis for each product.
   1. Specifically include percent solids-by-volume, volatile organic compound (VOC) content pound/gallon, and lead content (percent of weight of dried film).
   3. Schedule: List each material proposed for use, and cross-reference to specific paint system and substrate application.
      a. Identify each material by manufacturer's catalog number, product name, and generic classification.
      b. Include typewritten list identifying paint systems and colors applied to each room, space, or item.

C. Color and Sheen Samples: Prepare one sample of each opaque finish paint specified in each color and sheen scheduled for appearance verification.
   1. Apply to 12 by 12 by 1/4 inch hardboard. Apply sufficient paint thickness to provide proper hiding and appearance.
   2. Label each sample to indicate material, color, and sheen.

D. Painting System Samples:
   1. Prepare one sample of each transparent finish system scheduled on actual wood substrate proposed for use. Apply in each top coat color scheduled.
   2. Prepare one sample of each opaque paint system scheduled on actual substrate materials proposed for use. Apply in most common top coat color scheduled.
   3. Step back each coat and process at least one inch to show bare substrate and each coat and process in system build-up.
   4. Minimum sample size of 8-1/2 x 11 inches.
   5. Label each sample to indicate materials, color, sheen, DFT of each coat applied, and total system DFT.

E. Informational Submittals: Submit following:
   1. Certifications specified in Quality Assurance article.
   2. Qualification Data: Applicator's qualification data.
   3. Manufacturer's instructions.

F. Closeout Submittals: Submit specified warranty in accordance with Division 1.

1.5 QUALITY ASSURANCE
A. **Single Source Responsibility:** Provide products of single manufacturer for use in each paint system. Do not mix products of different manufacturers without approval of Architect and manufacturers involved.

B. **Applicator Qualifications:** Company specializing in commercial painting and finishing with three years documented experience.

C. **Regulatory Requirements:** Comply with CPSC 16 CFR 1303 and other applicable federal, state, and local regulations limiting lead content of paints to be applied.
   1. Comply with applicable local regulations limiting volatile organic compound (VOC) content of paints to be applied. Conduct and report measurement of volatile organic compounds in paints in accordance with EPA TM-24 or Architect approved method.

D. **Certifications:** Submit certification from manufacturer that materials furnished for use on this Project meet or exceed specified requirements and comply with applicable federal, state, and local requirements regarding lead content.

1.6 **FIELD SAMPLES**

A. **General:** Comply with Division 1.
   1. **Sample Installation:** Duplicate finishes of approved paint system samples on wall surfaces and other interior and exterior components selected by Architect.
   2. **Provide full-coat finish on at least 9 m² (100 square feet) of surface until required color, sheen, and texture are obtained. Simulate finished lighting conditions for review of in-place work.**
   3. **Request review by Architect of first finished room, space, or item for each paint system for color, texture, quality, and workmanship.**

1.7 **DELIVERY, STORAGE, AND HANDLING**

A. **Comply with Division 1.**
   1. **Deliver products to site in manufacturer's sealed and labeled containers; inspect to verify compliance with specified requirements.**
   2. **Label containers to indicate manufacturer's name, product name and type of paint, brand code or stock number, date of manufacture, coverage, surface preparation, drying time, cleanup, color designation and instructions for mixing and reducing.**
   3. **Store paint materials in tightly covered containers in well ventilated area at ambient temperatures of 45 F minimum and 90 F maximum, unless required otherwise by manufacturer. Maintain containers in clean condition, free of foreign materials and residue with labels in legible condition.**
   4. **Take precautionary measures to prevent fire hazards and spontaneous combustion.**

1.8 **PROJECT CONDITIONS**

A. **Environmental Conditions:** Comply with more restrictive of following or manufacturer's requirements under which systems can be applied.
   1. **Provide continuous ventilation during application of paints to exhaust hazardous fumes.**
   2. **Provide heating necessary to maintain surface and ambient temperatures within specified limits.**
   3. **Maintain temperature and humidity conditions for minimum 24 hours before, during, and 48 hours after application of finishes, unless longer times are required by manufacturer.**
   4. **Do not permit wide variations in ambient temperatures which might result in condensation on freshly coated surfaces.**
   5. **Provide illumination of not less than 80 foot candles)measured mid-height at substrate surface during application of paints.**
   6. **Apply water reducible paints only when ambient and surface temperatures are between 50 F and 90 F.**
7. Apply solvent reducible paints only when ambient and surface temperatures are between 45 F and 90 F.
8. Do not apply paints under any of following conditions:
   a. When surfaces are damp or wet.
   b. During snow, rain, fog, or mist.
   c. When relative humidity is less than 20 percent or exceeds 85 percent.
   d. When temperature is less than 5 F above dew point.
   e. When dust may be generated before paints have dried.
   f. In direct sunlight.
   g. When wind velocity is above 20 mph.
9. Application of paints may continue during inclement weather provided work areas and surfaces to be coated are enclosed and specified environmental conditions are maintained.

1.9 WARRANTY

A. Special Warranty: Prepare and submit in accordance with Division 1.
   1. Warrant installation to be free from defects in material and workmanship for five years.
   2. Repair or replace defects occurring during warranty period.
   3. Defects include but are not limited to pinholes, crazing or cracking, loss of adhesion to substrate, deficient thickness, improper materials and workmanship.

1.10 MAINTENANCE

A. Extra Materials: Furnish in accordance with Division 1.
   1. Provide one unopened gallon container of each type of opaque top paint in each color and sheen used on Project.
   2. Store where directed with labels intact.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Benjamin Moore, Montvale, NJ.
   2. Devoe & Raynolds, Louisville, KY.
   4. Glidden, Cleveland, OH.
   5. PPG Industries, Pittsburgh, PA.
   6. Pratt & Lambert, Buffalo, NY.
   7. Sherwin-Williams, Cleveland, OH.
   8. Tnemec, Kansas City, MO.
   9. Accepted Substitute in accordance with Division 1.

B. Listing of products by manufacturer’s trade name is not intended to exclude equivalent products by other manufacturers identified above. For products not specifically named, submit substitution request in accordance with Division 1.

2.2 PAINT MATERIALS – GENERAL

A. Paints: Ready-mixed, factory tinted, best professional grade produced by manufacturer.
   1. Fully grind pigments to maintain soft paste consistency in vehicle.
2. Capable of being dispersed into uniform, homogeneous mixture.

3. Possess good flowing and brushing properties.
4. Capable of drying or curing free of streaks or sags, and yielding specified finish.
5. VOC content of field applied paints shall not exceed limits after thinning as set by local authorities having jurisdiction

B. Refer to schedule at end of section for acceptable products and systems.

2.3 ACCESSORY MATERIALS

A. Muriatic Acid, Mildewcide, TSP (Tri-Sodium Phosphate), Acidic-Detergent, Zinc Sulfate, Sodium Metasilicate, And Solvent: Commercially available, non-damaging to surface being cleaned; as specified in PDCA Specification Manual; acceptable to paint manufacturer.

B. Metal Conditioner: Proprietary phosphoric acid based, etching type solution; acceptable to paint manufacturer.

C. Rust Inhibitor: Water containing 0.32 percent of sodium nitrite and 1.28 percent by weight of secondary ammonium phosphate (dibasic); or water containing 0.2 percent by weight of chromic acid or sodium chromate or sodium dichromate or potassium dichromate.

D. Spackling Compound, Putty, Plastic Wood Filler, Liquid De-Glosser, Latex Patching Plaster, Latex Base Filler, Thinners, and Other Materials Not Specifically Indicated But Required To Achieve Finishes Specified: Pure, of highest commercial quality, compatible with paints and acceptable to paint manufacturer.

E. Do not use products of different manufacturers in combination.

2.4 MIXING

A. Use factory prepared colors matching approved samples. Site tinting will not be permitted.

1. Thoroughly mix and stir paints before use to ensure homogeneous dispersion of ingredients. Prior to application, blend multiple containers of same material and color by pouring from one container to another several times to ensure uniform consistency, color, and smoothness.

2. Mix only in clean mixing pails of material recommended by manufacturer to avoid contamination.

3. Remove film which may form on surface of material in containers and strain material before using. Stir frequently during use to maintain pigments in suspension. Do not stir film into material.

4. Apply paints of consistency recommended by manufacturer. Thin only within recommended limits using thinners approved by paint manufacturer.

2.5 COLORS AND FINISHES

A. Finishes: Refer to finish paints schedule at end of this Section.

B. Colors: To be selected from Manufacturer’s Full Range by Owner/Architect

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with work in accordance with Division 1.
B. Measure moisture content of substrates using recently calibrated electronic moisture meter. Do not apply paints if moisture content of surfaces exceeds lesser of percentages listed below or those required by paint manufacturer. If excess moisture content exists and cannot be reduced, obtain written approval of paint manufacturer before application of paints.

2. Architectural Woodwork, Trim, Cabinets, and Casework: 10 percent; measure with resistance-type meter in accordance with ASTM D4442.
3. Common Board and Dimension Lumber: 12 percent; measure with resistance-type meter in accordance with ASTM D4442.
5. Canvas and Cotton Insulation Coverings: 12 percent max.

C. Prior to applying alkali and acid sensitive paints, test surface pH with universal pH paper placed against wetted surface. Substrate pH shall not exceed pH of clean wash water.

D. Beginning of execution constitutes acceptance of existing conditions.

3.2 PREPARATION – GENERAL

A. Protect completed construction from damage. Furnish drop cloths, shields, and protective methods to prevent spray, splatter, or droppings from disfiguring other surfaces.

B. Remove surface hardware, mechanical diffusers, escutcheons, registers, electrical plates, light fixture trim, fittings, fastenings and similar items prior to preparing surfaces for finishing. Provide surface-applied protective masking for non-removable items. Carefully store removed items for reinstallation.

1. Remove mildew by scrubbing with mildewcide. Rinse thoroughly with clean water.
2. Before beginning application of paints, ensure surfaces are clean, dry, and free of dirt, dust, rust or rust scale, oil, grease, mold, mildew, algae, efflorescence, release agents, or any other foreign material which could adversely affect paint adhesion or finished appearance.

3.3 SURFACE PREPARATION FOR NEW WORK

A. General: Correct minor defects.

1. Remove temporary labels, wrappings, and protective coverings from surfaces to be coated.
2. Seal stains, marks, and other imperfections which may bleed through surface finishes.

B. Aluminum: Clean in accordance with SSPC SP1 “Solvent Cleaning”.

1. Apply etching type primer.

C. Concrete: Prior to application of paints, allow surfaces to cure minimum 60 days.

1. Remove dirt, scale, powder, laitance, and bond breakers by light sandblasting to minimum 1.5 mil profile.
2. Remove oil and grease with solution of TSP; rinse well.
3. Remove stains caused by weathering or corroding metals with solution of sodium metasilicate applied after thoroughly wetting surface with potable water; allow to dry.
4. Fill cracks and voids with compatible filler.

D. Steel - Uncoated: Remove weld spatter by chipping or grinding.
1. Clean interior and weather protected steel in accordance with SSPC SP2 "Hand Tool Cleaning" and SP3 "Power Tool Cleaning". Clean areas of excessive corrosion or scale in accordance with SSPC SP7 "Brush-Off Blast Cleaning".
2. Clean exterior steel permanently exposed to elements in accordance with SSPC SP6 "Commercial Blast Cleaning".
3. Apply metal conditioner to bare surfaces in accordance with manufacturer's recommendations, paying particular attention to abrasions, welds, bolts, and nuts. Allow to set as recommended by solution manufacturer. Rinse with clean water with rust inhibitor mixed with water or applied immediately following rinse. Allow to dry.
4. Prime coat immediately.

E. Steel - Prime Coated: Remove loose primer and rust to feather-edge at adjacent sound primer by cleaning in accordance with SSPC SP2 "Hand Tool Cleaning" and SP3 "Power Tool Cleaning".
   1. Apply metal conditioner to abrasions, welds, bolts, and nuts in accordance with manufacturer's recommendations. Allow to set as recommended by manufacturer. Rinse with clean water with rust inhibitor mixed with water or applied immediately following rinse. Allow to dry.
   2. Prime coat bare areas immediately.

F. Steel - Galvanized: Remove white rust by cleaning in accordance with SSPC SP2 "Hand Tool Cleaning" and SP3 "Power Tool Cleaning". Exercise care not to remove galvanizing.
   1. Pretreat surfaces to receive solvent reducible coatings immediately.

G. Wood - Opaque Finish: Remove excess residue from knots, pitch streaks, cracks, open joints, and sappy spots. Remove or seal over grade stamp markings.
   1. Sand wood surfaces and edges smooth. Remove dust after each sanding.
   2. Apply compatible stain sealer to knots, pitch and resinous sapwood before applying prime coat. Do not apply shellac to exterior surfaces, or under latex or urethane finishes.
   3. After primer is dry and before second coat, countersink nails and fill nail holes, cracks, open joints and other defects with putty or plastic wood filler.

3.4 APPLICATION

A. General Requirements: Coat all surfaces specified, scheduled, illustrated, and otherwise exposed unless specifically noted otherwise.
   1. Apply paints of type, color, and sheen as scheduled.
   2. Apply products in accordance with Division 1. Use application materials, equipment, and techniques as recommended by paint manufacturer and best suited for substrate and type of material being applied.
   3. Do not apply finishes to surfaces that are improperly prepared.
   4. Number of coats specified are minimum number acceptable.
   5. Apply paint systems to total dry film thickness scheduled. Apply material at not less than manufacturer's recommended spreading rate. Do not exceed maximum single coat thickness recommended by paint manufacturer. Do not double-back with spray equipment building up film thickness of two coats in one pass.
   6. Ensure that edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent of flat surfaces.
   7. Finish edges of paints adjoining other materials or colors sharp and clean, without overlapping.

B. Prime Coats: Apply initial coat to surfaces as soon as practical after preparation and before subsequent surface deterioration.
   1. Backprime exterior woodwork with specified primer.
   2. Backprime interior woodwork scheduled to receive transparent finish with gloss varnish reduced 25 percent with mineral spirits.

C. Intermediate and Top Coats: Allow previously applied coat to dry before next coat is applied.
1. Sand and dust lightly between coats as recommended by paint manufacturer.
2. Apply each coat to achieve uniform finish, color, appearance, and coverage free of brush and roller marks, runs, misses, visible laps or shadows, hazing, bubbles, pin holes, or other defects.
3. If stains, undercoats, or other conditions show through final topcoat, correct defects and apply additional topcoats until paint film is of uniform finish, color, and appearance.

D. Finish Matching: Finish closets same as adjoining rooms, unless otherwise specified.
1. Finish tops, bottoms, and edges of doors same as door faces. Apply sanding sealer to cut-outs. When faces are different colors, finish edges of doors to match space from which they are visible when door is in partly open position.
2. Finish other surfaces not specifically mentioned to match adjoining surfaces.

E. Mechanical and Electrical Items: Refer to Division 15 - Mechanical and Division 16 - Electrical for schedule of color coding and identification banding of equipment, ductwork, piping, and conduit. Color code equipment, piping, conduit and exposed ductwork in accordance with requirements indicated.
1. Prior to finishing mechanical and electrical items, remove louvers, grilles, covers, and access panels and finish separately. Replace when dry.
2. Paint interior surfaces of ducts, and heating cabinets that are visible or reflective behind grilles and registers with one coat of flat black paint.
3. Finish dampers visible behind grilles and registers to match space finish.
4. Paint both sides and edges of plywood equipment backboards before installing equipment.
5. Do not apply paints over name plates, tags, or other equipment identification.

F. Reinstall trim, fittings, and other items removed for finishing.

3.5 FIELD QUALITY CONTROL

A. General: Comply with requirements of Division 1.
1. Periodically test film thickness of each coat with wet film gage to ensure paints are being applied to proper thickness.
2. Request review of each applied coat by Architect before application of successive coats. Only reviewed coats will be considered in determining number of coats applied.
3. Immediately prior to Substantial Completion, perform detailed inspection of painted surfaces and repair or refinish abraded, stained, or otherwise disfigured surfaces.

3.6 CLEANING

A. Promptly remove spilled, splashed, or spattered paints. Clean spots, oil, and other soiling from finished surfaces using cleaning agents and methods which will not damage materials.
1. If completed construction is damaged beyond normal cleaning or repair by painting operations, replace damaged items at no additional cost to Owner.
2. Maintain premises and storage areas free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
3. Collect waste, cloths, and material which may constitute fire hazards and place in closed metal containers; remove from site daily along with empty containers.

3.7 PROTECTION

A. Protect finished work in accordance with Division 1.
1. Protect work of other trades against damage from paint activities. Correct damage by cleaning, repairing, replacing, and repaint as acceptable to Architect.
2. Provide "Wet Paint" signs and other methods to protect newly coated surfaces. Remove when directed or when no longer needed.

3.9 EXTERIOR PAINTING SCHEDULE:

1. Concrete, Stucco and Masonry (Other than concrete masonry units.
   1st Coat......Primer
   2nd Coat......Tneme-Cryl Acrylic Latex
   3rd Coat......Tneme-Cryl Acrylic Latex

2. Concrete Masonry Units:
   1st Coat......Block Filler
   2nd Coat......Latex House Paint
   3rd Coat......Latex House Paint
   Not less than 2.5 mils dry film thickness, excluding first coat.

3. General Painted Wood/Fiber Cement board:
   1st Coat......Exterior Primer
   2nd Coat......Eggshell Finish House Paint
   3rd Coat......Eggshell Finish House Paint

4. Painted Wood/Fiber Cement Trim:
   1st Coat......Exterior Primer
   2nd Coat......Eggshell Finish House Paint
   3rd Coat......Eggshell Finish House Paint

5. Painted Plywood:
   1st Coat......Surface Sealer
   2nd Coat......Exterior Primer
   3rd Coat......Eggshell Finish House Paint
   4th Coat......Eggshell Finish House Paint

7. Ferrous Metal:
   1st Coat......Rust Inhibitive Paint
   2nd Coat......High Gloss Enamel
   3rd Coat......High Gloss Enamel
   First Coat not required on items delivered shop primed.

8. Zinc-Coated Metal:
   1st Coat......Galvanized Metal Primer
   2nd Coat......High Gloss Enamel
   3rd Coat......High Gloss Enamel

END OF SECTION 09910
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes equipment for foodservice facilities indicated on the Drawings.

B. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment items.

C. Related Sections include the following:
   1. Division 15 Sections for supply and exhaust fans; exhaust ductwork; service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; fire-extinguishing systems; and other materials required to complete foodservice equipment installation.
   2. Division 16 Sections for connections to fire alarm systems, wiring, disconnect switches, and other electrical materials required to complete foodservice equipment installation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Manufacturer's model number.
   2. Options, accessories, and components that will be included for Project.
   3. Clearance requirements for access and maintenance.
   4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.

B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.

C. Coordination Drawings: For foodservice facilities.
   1. Indicate locations of foodservice equipment and connections to utilities.
   2. Key equipment using same designations as indicated on Drawings.
   3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of support for equipment; and utility service characteristics.
   4. Include details of seismic bracing for equipment.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Operation and Maintenance Data: For foodservice equipment to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:
   1. Product Schedule: For each foodservice equipment item, include the following:
      a. Designation indicated on Drawings.
      b. Manufacturer's name and model number.
c. List of factory-authorized service agencies including their addresses and telephone numbers.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF/ANSI standards.

1. Provide BISSC-certified equipment, with certification verified by a third-party agency.

B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards and that are UL certified for compliance and labeled for intended use.

C. Regulatory Requirements: Install equipment to comply with the following:

3. NFPA 70, "National Electrical Code."

1.5 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Coordination Drawings.

1.6 COORDINATION

A. Coordinate foodservice equipment layout and installation with other work, including lighting fixtures, HVAC equipment, and fire-suppression system components.

B. Coordinate location and requirements of utility service connections.

C. Coordinate size, location, and requirements of the following:

1. Overhead equipment supports.
2. Equipment bases.
3. Floor depressions.
4. Insulated floors.
5. Floor areas with positive slopes to drains.
6. Floor sinks and drains serving foodservice equipment.
7. Equipment supports, and penetrations.

1.7 WARRANTY

A. Refrigeration Compressor, Mechanical Components and cooler/freezer enclosure Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.

1. Failure includes, but is not limited to, inability to maintain set temperature.
2. Warranty Period: 5 year from date of Substantial Completion.

B. Performance Warranty Period: 1 yr from date of Substantial Completion
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Basis-of-Design Product: The design for foodservice equipment item is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 WALK-IN REFRIGERATION EQUIPMENT

A. Walk-in Refrigeration Unit: As listed in Equipment Schedule on A202
   1. Manufacturers:
      a. AMERIKOOLER
      b. U.S. COOLER
      c. Master-Bilt
      d. Approved equal
   2. Description: Two-compartment unit, with cooler and freezer compartments as shown on drawings and equipment schedule on sheet A202.
   4. Floors: Insulated floor panels
   5. Doors:
      a. Hinges: Self-closing and spring loaded; two per door
      b. Latch: Edge-mounted, positive-type latch with cylinder lock
         1) Include safety-release handle that opens door from inside when door is locked.
      c. Options and Accessories:
         1) Pressure relief port.
         2) Threshold: Stainless steel, factory installed.
         3) Anticondensate heater at freezer doors.
   7. Interior Finish: Smooth, mill-finished aluminum
   8. Vaporproof Lighting Fixtures: LED fixture equal to wattage of 100-W Incandescent lamp
      a. Control: Neon pilot light and toggle switch located on exterior of door panel.
      b. Quantity: One per compartment, centered on door panel
   9. Refrigeration System: Remote system with preassembled condensing unit and evaporator assemblies. Both cooler and freezer condensing units shall be mounted on concrete pad behind units with copper ACR refrigerant piping and brazed connections. Insulate with 1” fiberglass and PVC jacketing on both suction/liquid piping.
      a. Exterior Condensing Units: Include winter control, crankcase heater, and enclosed weatherproof housing.
      b. Operating Temperature: 35 deg F for cooler, 22 deg F for freezer.
10. Temperature Monitoring System: Electronic thermostat monitoring mounted in each cooler/freezer and remote audible alarm system that warns when temperatures exceed 10 deg F (6 deg C) above or below set temperature.


2.3 MISCELLANEOUS MATERIALS

A. Installation Accessories, General: NSF certified for end-use application indicated.

B. Elastomeric Joint Sealant: ASTM C 920: Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.

   1. Public Health and Safety Requirements:
      a. Sealant is certified for compliance with NSF standards for end-use application indicated.
      b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.

2. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter larger than joint width.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install foodservice equipment level and plumb, according to manufacturer's written instructions.
   1. Connect equipment to utilities.
   2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

B. Complete equipment assembly where field assembly is required.
   1. Provide closed butt and contact joints that do not require a filler.
   2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish.

C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and requirements of authorities having jurisdiction.

D. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

E. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

3.2 CLEANING AND PROTECTING

A. After completing installation of equipment, repair damaged finishes.

B. Clean and adjust equipment as required to produce ready-for-use condition.

C. Protect equipment from damage during remainder of the construction period.
3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain foodservice equipment. Refer to Division 1 Section "Closeout Procedures, Demonstration and Training."

END OF SECTION 11400
SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Provide items, articles, materials, operation and methods required by drawings and specifications including labor, equipment, supplies and incidentals necessary for completion of work in Division 22 – Plumbing.


1.2 RELATED DOCUMENTS

A. The General Provisions described herein, together with the conditions of contract, and the General Requirements of Division 1, apply to the work in Division 22 – Plumbing.

B. This Section is hereby made a part of all other Sections of Division 22 – Plumbing, as if repeated in each.

1.3 QUALITY ASSURANCE

A. All permits and licenses that are required by governing authorities for the performance of shall be procured and paid for by the Contractor.

B. All work shall be performed in compliance with all applicable and governing safety regulations including the regulations of the Occupational and Safety Health Act. All safety lights, signs and guards required for performance of work shall be provided by the Contractor.

C. All work shall conform to the requirements of all applicable codes, ordinances and regulations including the rules and regulations of the National Electrical Code, the National Fire Protection Association, the International Plumbing Code, OSHA and all State and Local laws, codes and ordinances.

D. Laws, codes, ordinances and regulations shall take precedent excepting only where the work called for by the drawings and specifications exceeds by quality and quantity.

E. Fixtures, appliances, equipment and materials which are subject to Underwriter's Laboratory tests shall bear such approval.

F. Mechanical and electrical designs are based on the requirements for the specified manufacturers listed on the equipment schedules. Conduit, disconnects, motor starters, breakers, fuses and wire sizes are selected on basis of scheduled equipment. Increased current requirements necessitating larger wire, breakers, switches, etc., to accommodate any alternate or substitute manufacturer's equipment, other than as shown on drawings shall be provided without any increase in contract price by contractor furnishing the equipment.

G. Manufacturers, where specifically called for, must provide factory tests, unit installation observations, unit start-up and tests, etc., as specified, and submit signed reports to the Engineer upon completion of these services. Subletting of these services will not be permitted. Shop drawing submittals shall be accompanied with a letter of certification by the manufacturer that the specified services shall be provided. Failure to do so shall be cause to reject the shop drawing submittals.
H. The contract drawings are in part schematic and intended to convey the scope of work and indicate the general layout, design and arrangement. The Contractor shall follow these drawings in the layout of his work and shall consult general construction drawings, electrical drawings and all other drawings for this project, and shall verify all existing site conditions to determine all conditions affecting the work shown or specified. The contract drawings are not to be scaled and the Contractor shall verify spaces in which the work is to be installed.

I. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, Engineer shall be notified before proceeding with installation.

J. Work in cooperation with one another to fit piping and work from other Divisions into the structure as job conditions may demand. All final decision as to right of way and run of pipe, ducts, etc. to be made by Engineer or his representative.

K. All work shall be performed by trained mechanics of a particular trade involved and done in neat and workmanlike manner as approved by "Engineer".

   1) Work shall be performed in cooperation with other trades and scheduled to allow timely and efficient completion of project.

   2) Furnish other trades advance information on locations and sizes of frames, boxes, sleeves and openings needed for work, and also furnish information and shop drawings necessary to permit other trades affected to install their work properly without delay.

   3) Where there is evidence that work of one trade will interfere with work of other trades, all trades shall assist in working out space conditions to make satisfactory adjustments.

L. Work installed before coordinating with other trades causing interference with work of such other trades shall be changed to correct such condition without increase in contract price and as directed by Engineer.

M. Where specific details and dimensions are not shown on the drawings, the Contractor shall take measurements and make layouts for the proper installation of the work and coordination with all other work on the project. In case of any discrepancies between the drawings and the specifications, it shall be assumed, by the signing of the Contract, that the higher cost (if any difference in costs) is included in the contract price, and the Contractor shall perform the work in accordance with the drawings or with the specifications, as determined and approved by the Engineer.

N. The Contractor shall be responsible for a scheduled sequence in performing the work so that it will not interfere with the Owner's operation in the existing building. Before any work is started, the Contractor shall consult with the Engineer and Owner and arrange a satisfactory schedule.

   1) Make temporary alterations as required to execute work so that all operations and services in the existing building are maintained with the minimum possible interruption.

   2) Temporary shut-downs shall be segregated and shall be of the shortest possible duration. All facilities shall be kept in continuous operation unless specific permission to the contrary is granted by Owner.

O. Definitions:

   1) "Piping" includes, in addition to pipe, all fittings, valves, sleeves, hangers, and other supports and accessories related to such piping.

   2) "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, or in crawl spaces.

   3) "Exposed" means not installed underground or "concealed" as defined above.
4) The words "furnish and install", "provide", "furnish", "install", or equivalent words are used or are understood, to mean the Contractor shall furnish and completely install the system, service, equipment, or material named, together with other associated devices, equipment, material, wiring, piping, etc. as required for a complete operating installation, and conforming to the manufacturer's standards and recommendations.

5) It is the intent of these specifications and drawings to call for finished work, tested and ready for operation.

6) All apparatus, appliances, materials or work not shown on drawings, but mentioned in specifications, or vice versa, and/or all incidental accessories necessary to make work complete and ready for operation, even though not specified or shown on drawings, shall be furnished and installed without increase in contract price.

7) Should there be discrepancies or questions of intent, refer matter to Engineer in writing for decision before ordering any equipment or materials or before starting any related work.

1.4 SHOP DRAWINGS AND SAMPLES

A. Shop drawings, project data and samples furnished by the Contractor shall illustrate materials, equipment or workmanship, and establish standards by which the work will be judged.

B. Shop Drawings and Samples shall be submitted to the Engineer by a letter of transmittal. The party making the submission shall be named on Shop Drawing/Sample and also in the letter of transmittal.

C. When Shop Drawing submissions are in the form of loose pages (8 1/2" x 11") they shall be submitted in sets assembled in portfolio binders showing on the covers or first page inside, a complete list of contents. A minimum of 7 sets of each submission are required, however, additional copies may be requested.

D. The Contractor shall review, stamp with his approval and submit, with reasonable promptness and in orderly sequence so as to cause no delay in the work or in the work of any other contractor, all Shop Drawings and Samples required by the Contract Documents or subsequently by the Engineer as modifications. Shop Drawings and Samples shall be properly identified as specified or as the Architect/Engineer may require. At the time of submission, The Contractor shall inform the Architect/Engineer in writing of any deviation in the Shop Drawings or Samples from the requirements of the Contract Documents.

E. Except in the case of brochures, catalogue cuts and the like, shop drawings shall be in the form of a reproducible print(s) (sepia). In every case, the submittal shall consist of one sepia of each shop drawing and two (2) black line prints of the same. Each print shall be made from the original shop drawing tracing. The transparency shall be capable of producing clean, clear black and white prints.

F. Contractor shall stamp each sepia and black line print (shop drawing) the same. He shall also stamp each brochure, sample and the like. Special Note: Every page with project information shall be reviewed by the Contractor and shall also be signed by the Contractor indicating that the document has been reviewed, and that it is approved by the Contractor. The submittals will not be reviewed without the Contractor’s approval stamp and signature.

G. The Contractor's approval stamp and signature shall signify that the Contractor has checked the submittals. Any submittals which have not been checked shall be returned to the Contractor for checking, approval stamp, signature, and resubmittal for compliance with the contract documents. After review of the submittals they will be returned to the Contractor with one of the following remarks checked:

1) No Exceptions Taken SUBJECT TO CONTRACT DOCUMENTS.
2) Note Corrections SUBJECT TO CONTRACT DOCUMENTS
RESUBMISSION NOT REQUIRED.

3) Revise and Resubmit REVISE, RESUBMISSION REQUIRED.

4) Rejected NOT APPROVED.

H. Upon receipt of exhibits submitted and marked for resubmittal the Contractor shall cause the marked corrections and corrections that may be contained in the Architect/Engineer transmittal letter to be made on each submittal. All such corrections shall be circled, numbered, and dated to permit prompt reviewing upon resubmittal to the Architect/Engineer. Upon receipt of each submittal now marked:

I. The Contractor shall cause submittals to be distributed to the respective contractors and suppliers as is necessary for proper performance of work.

J. At the time of submission, the Contractor shall inform the Engineer in writing of any deviation in the exhibits submitted from the requirements of the Contract.

K. The Engineer will review exhibits submitted with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the Project and with the information given in the Contract. The Engineer's review of a separate item shall not indicate review of an assembly in which the item functions. The Engineer's review is not intended to indicate approval of dimensions or quantities.

L. Contractor shall make any corrections required by the Engineer and shall resubmit the required number of submittals until further resubmittals are no longer required.

M. Engineer's review of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract unless the Contractor has the Engineer's approval in writing of such deviation at the time of submission and the Owner's Representative has given written notice to the specific deviation; nor shall the Engineer's review relieve the Contractor from responsibility for errors or omissions in the submitted exhibits.

N. No portion of the work requiring a submittal shall be commenced until the Engineer has reviewed the submission. All such portions of the work shall be in accordance with reviewed submittals.

1.5 OPERATION AND MAINTENANCE MANUALS

A. In addition to the requirements specified in Division 1, the Contractor at the project’s completion shall submit a complete system operating and maintenance manual. O&M manual shall be organized into systems and shall contain the manufacturer’s complete detailed operating and maintenance instructions with equipment data for each piece of installed equipment furnished under this project. Manual at a minimum shall include the following:

B. Manual shall be composed of typed instructions sheets with large drawing sheets (not reduced) folded in with reinforced margin, shall have a post binder system so that sheets can be easily substituted, and shall have a hard cover.

C. Include in O&M manuals Manufacturers written maintenance instruction for each different piece of equipment provided and installed on this project.

D. Include spare parts list for each major piece of equipment furnished for the project including but not limited to medical gas zone panels, control panels, and accessories.

E. Provide a comprehensive list of maintenance procedures for preventative maintenance and troubleshooting; disassembly, repair and reassemble; aligning and adjusting instructions.
PART 2.  EQUIPMENT

2.1  GENERAL

A. All materials and equipment shall be new and shall bear manufacturer's name, model number and other identification marking.

B. All materials and equipment shall be standard product of manufacturer regularly engaged in production of required type of material or equipment for at least 5 years (unless specifically exempted by Engineer) and shall be manufacturer's latest design having published properties.

2.2 EQUIPMENT FURNISHED BY OWNER OR OTHER TRADES

A. Owner furnished equipment includes the following:
   1) None

B. Equipment furnished by other trades includes the following:
   1) None

C. General
   1) The following paragraphs describe the Contractor's responsibilities for receiving and installing this equipment after shipment from the Manufacturer. Contractor shall complete all installation in accordance with this and other relevant Sections within this Division.

D. Receiving and Inspection
   1) All equipment is shipped F.O.B to the jobsite. All delivery and transportation charges will be prepaid, so that Contractor will not incur additional shipping charges. Upon receipt of equipment, Contractor shall inform Owner/Owner's Representative and provide a copy of the bill of lading. Maintain delivery records for inventory control and for use in processing payment request vouchers. Crosscheck delivery records with project schedule so as to eliminate work stoppages due to material shortages.

   2) The Contractor shall be responsible for coordinating with the manufacturer for installation of the equipment furnished above as shown on drawings. The Contractor shall be responsible for warranty work required and shall coordinate with the manufacturer of the equipment to accomplish warranty work including any labor and additional cost for such warranty work. The Equipment Manufacturer shall provide the Contractor with installation manuals and instructions to the Contractor. The Contractor shall receive and install this equipment for a complete furnished and installed installation including all accessories as specified within these specifications and as shown on drawings.

   3) The Contractor shall check equipment and trim delivered to job site by Equipment Supplier against approved shop drawings or other required documentation. The Contractor shall report all discrepancies, shortages, or lack of data to the Owner and Equipment Supplier for adjustments within 1 week after equipment is received. If such report is not made within one week, it shall be assumed no discrepancies, shortages, or lack of data has been found.

   4) The Contractor is responsible for off-loading of shipped equipment. Contractor shall handle products, materials, and equipment in accordance with manufacturer's recommendations and recognized industry standards. Contractor shall utilize lifting lugs, and designated lift points when hoisting equipment. In all cases, Contractor shall carefully handle, transport, and position items to prevent damage during construction.

   5) An access restricted area shall be provided for the storage of all supplemental equipment, accessories and materials. This restricted area shall be divided into two distinct areas designated
as “quarantined” and “released”. The storage area designated as “quarantined” shall be used to store equipment, materials and accessories prior to inspection and acceptance. Under no circumstances shall an item be removed from quarantined storage until it designated as “released”. After the equipment, material or accessory has been inspected and approved for installation, based on the review of specifications and drawings, the item shall be relocated to the “released” area, where the contractor shall install the unit according to the project schedule.

6) Contractor shall store equipment and components in a manner to prevent damage and degradation. Store items on skids or pallets, elevated above the floor or grade. Store items subject to moisture damage in a dry location. Retain protective shipping covers, crates, and cartons during storage. Protect items from contamination by jobsite dirt and debris and other foreign matter. Provide a secure, fenced and lighted area for outside jobsite storage where required.

7) The Contractor is responsible for inspection and verification of all supplemental equipment. Contractor shall verify all equipment received is properly marked with product names, model numbers, types, grades, compliance labels, and other information needed for identification.

8) Shipment shall be verified in accordance with all data and information on specifications and submittals, including quantities, accessories, sizes, dimensions, utility requirements and general compliance. Contractor is responsible for final dimensions, verification of installation requirements and utility connections, which shall be confirmed at the job site. Contractor shall notify the Owner/Owner’s Representative of any deviations from the requirements of the Purchase Order, Drawings, or Specifications.

9) Contractor shall receive and inspect all tanks and agitators. Shipment shall be verified with approved shop drawings, and all attachments shall be accounted for. If any accessory is not received contractor shall notify manufacturer. Contractor is responsible for tracking receipt and storage of all tanks and appurtenances.

10) If, during the course of inspection or installation, any of the goods received are found to be defective in material or workmanship, or otherwise not in conformity with the Purchase Order requirements, the Contractor shall notify the Owner/Owner’s Representative, who shall retain the right to reject or revoke acceptance and return the goods. Such goods are not to be repaired, altered or replaced without written authorization from the Owner/Owner’s Representative.

E. Installation

1) Contractor shall verify and integrate the installation of the supplemental equipment with the various elements of the building systems based on their review of latest information provided in the approved submittal data and coordination drawings. Install supplemental equipment to conform with all utility systems, electrical components and controls based on the Construction Drawings and the associated specifications provided. Where coordination requirements conflict with individual system requirements refer conflict to the Owner/Owner’s Representative.

2) If greater capacity or more materials or labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then it shall be the responsibility of the parties involved in providing the substitute and/or equivalent items of equipment to provide all compensation for additional charges made for the proper rough-in, circuitry and connections for the equipment furnished.

3) Contractor shall install supplemental equipment where indicated in the Construction Drawing set, in accordance with equipment manufacturer’s written instructions and with recognized industry practices, to ensure that the equipment complies with requirements and serves intended purposes. Contractor shall install supplemental equipment in accordance with manufacturer’s installation instructions, level and plumb, firmly anchored, and maintain manufacturer’s recommended clearances for servicing and maintenance.
4) Contractor shall connect and install all appurtenances, accessories and devices furnished by manufacturer but not specified to be factory-mounted or packaged separately for protection during shipping. For example, remote automated valves, utility booster pumps or tank agitators shall be installed per manufacturer’s recommendations as indicated on the drawings.

5) After placement or installation, cover items with tarps or sheeting where required to protect from damage during construction.

6) Contractor shall install tanks level and plumb. Installation of weigh cells, if required, under tanks shall be completed where indicated on drawings. Installation of tanks through floors, if required, shall be completed as indicated on drawings. Contractor shall install all appurtenances not installed at manufacturer’s facility.

7) After installation is approved, all agitators shall be bumped to check rotation.

F. Start-up and Commissioning

1) Prior to final acceptance, operate systems and equipment for a minimum of 48 continuous hours after normal operating conditions are achieved, as approved by the Owner/Owner’s Representative. The Contractor shall obtain suitable training or assistance for the operation of unfamiliar systems or equipment prior to start-up or operation. The Contractor shall clean systems or equipment and install new filters, screens, etc. based on manufacturer’s recommendations prior to final acceptance by the Owner/Owner’s Representative.

2) Adjust all systems and equipment to provide operation as described on the drawings and specified herein. Properly align and adjust drive components, bearings, etc. for all equipment to eliminate excess noise and vibration as acceptable to the Owner/Owner’s Representative.

3) Commissioning is the process of verifying that the installation of equipment has been completed in a manner that allows safe and acceptable start-up, and that the equipment is functioning as intended. Commissioning encompasses the testing and documentation required to be completed before the Contractor is finished. It will serve as a tool to alleviate post-occupancy difficulty or failure of supplemental equipment, and shall record data in an effort to advance the systems from a state of substantial completion to dynamic operation and assist in the validation documentation. The Owner/Owner’s Representative and any issuance of completion certification shall complete the commissioning documentation prior to equipment installation acceptance. The documentation shall consist of Owner/Owner’s Representative provided checklists to be completed by the appropriate Contractor, and verified by the Owner or Owner’s Representative. In many instances, the equipment Manufacturer will assist with commissioning services after installation. However, it is the responsibility of the Contractor to complete all documentation.

4) Commissioning activities shall be guided by protocols and datasheets furnished by Owner/Owner’s Representative, and will consist of installation verification, operational verification and documentation. An example of the commissioning documentation has been provided with the construction specifications. The Contractors responsibilities for installation verification will consist of an installation audit that will include information pertaining to material verification, manufacturer and model number, utility connections and flow data, loop checks, cleaning and passivation. The Contractor’s responsibilities for operational verification will consist of an operational audit that will consist of information pertaining to calibration, input/output testing, operating and control demonstration, alarm verification, and start-up.

2.3 FIRESTOPPING

A. Firestopping is defined herein as the process of furnishing and installing a material, or combination of materials, in various constructions to maintain an effective barrier against the spread of flame,
smoke, and gasses and to retain the integrity of time-rated construction. It shall be used in specific locations as specified hereinafter.

1) Piping penetrations through floor slab and through time-rated partitions of fire walls;

2) Opening between floor slabs and curtain walls, including inside hollow curtain walls at the floor slab;

3) Penetrations of vertical service shafts;

4) Openings and penetrations in enclosures with time-rated fire doors;

5) Other locations where specifically shown on drawings or where specified in other sections of these specifications;

6) Openings in non-time-rated construction shall be closed with a compacted fill of ¾ lb. density fiberglass and then sealed gas tight.

B. Material of firestopping shall be asbestos free and capable of maintaining an effective barrier against flame, smoke and gases in compliance with the requirements of ASTM E 814, UL NO. 1479. Fire-stopping material shall be manufactured by 3M barrier products. Products shall be capable of providing a cold smoke and water seal. When exposed to temperatures exceeding 250ºF these products shall rapidly expand up to ten times the original volume.

C. Installation of fire stopping shall be in accordance with the manufacturer’s recommendations and requirements. Surface to be in contact with firestopping shall be cleaned of dirt, grease, oil, loose materials, rust, or other substance that may affect proper fitting or the required fire resistance.

D. Firestopping materials shall provide an effective barrier regardless of the geometric configurations of the void spaces. Firestopping materials for filling voids in floors having openings of four (4) inches or more shall be installed to support the same load as the floor is designed to support, unless the area is protected by a permanent barrier preventing loading or traffic on the fire-stopped area.

E. At a minimum fire stop systems shall be designed to achieve a 2-hour F rating with an emphasis on also achieving a 2-hour T rating. In addition to fire and thermal protection, fire stop systems shall be designed to provide a barrier to the transmission of smoke and toxic fumes.

F. A firestop system as defined by these specifications shall consist of fire barrier products, in certain configuration and quantity, to meet the intent of the specifications above.

G. Firestop systems for floor and chase penetrations shall be installed on both sides of the penetration (top and bottom) (in and out). Firestop systems shall be symmetrically installed on both sides and shall meet or exceed all requirements for AT&T standard practices.

2.4 ELECTRICAL EQUIPMENT

A. General: Unless specifically specified or shown otherwise, the Contractor shall furnish required motors, variable speed drives with controls, and disconnect switches for equipment furnished under this Division. Motors, drives, and associated controls, and disconnecting equipment shall be provided where indicated and as required for operation of the equipment being furnished. Motors shall be designed for full voltage starting unless otherwise specified or noted on drawings and shall be suitable for continuous duty at 40 C. ambient. All motors shall be selected, designed and fabricated in conformance with the requirements of NEMA-MG-1 standard.

B. All motors shall be NEMA Design B induction motors with voltage and phase scheduled on drawings. Motors shall be equipped with Class F insulation, rated with a service factor of 1.15 and nominal full-load efficiency within 1.5% of the maximum values provided by the National Electrical Manufacturers Association Standard 12.6C in publication MG 1. The motor efficiency testing standards for all motors is IEEE Standard 112-1984, "Standard Test Procedure for Polyphase Induction Motors and
Generators”. All motors shall have a 2% - 5% power factor improvement over typical standard efficient motors. Motors shall comply with the frame size assignments of NEMA MG 13-1984. Motor nameplate horsepower ratings shall not be exceeded when the equipment is operating within the limits of the design conditions specified. The motor loading shall not exceed the motor service factor rating on start-up conditions or at the equipment maximum load point.

C. Rating: Motor rating, service factor and nameplate data shall conform to the requirements of NEMA-MG-1 standards. Motor nameplate horsepower ratings shall not be exceeded when the equipment is operating within the limits of the design conditions specified. The motor loading shall not exceed the motor service factor rating on start-up conditions or at the equipment maximum load point.

D. Nameplate data shall conform to NEMA MG 1 requirements. For motors of one horsepower and greater, the following additional nameplate data shall be included:

1) Manufacturer's identification number
2) Frame size number
3) Insulated system class designation
4) Service factor
5) Locked-rotor KVA code letter
6) Starting limitations (if any)
7) Hazard classification (if approved)

(a) Design and construction of each motor shall be coordinated with the driven equipment requirements.

E. Service factor - All motors of one horsepower and greater shall be furnished with a service factor of 1.15 in accordance with NEMA-MG-1.

F. Enclosures - All motors shall be self-cooled. Motors for indoor service shall have drip-proof enclosures. Motors for outdoor service shall be totally enclosed and shall have all exposed metal surfaces protected, where practical, with a corrosion resistant polyester paint or coating. Exposed unpainted and uncoated metal surfaces shall be of a corrosion resistant material. All self-ventilated open type motors and the fan hoods of totally enclosed fan cooled motors shall meet NEMA MG 1 requirements for a fully guarded machine. Totally enclosed motors shall be furnished with cast iron frames, bearing brackets and terminal housings. Fan cooled motors shall have fans fabricated of corrosion resistant metal and cast iron fan covers.

G. Bearings for fractional horsepower motors shall be designed to operate in any position or angle. One-piece sleeve bearings with wick lubrication shall be furnished where available. Ball bearings shall be furnished where sleeve bearings are not available and where axial thrust loads exceed 20 pounds.

H. Bearings for motors of one horsepower and greater shall be oil lubricated sleeve bearings. If motor frame size is such that sleeve bearings are not available, bearings shall be grease lubricated rolling element type, self-lubricated and re-greaseable.

2.5 DISCONNECT SWITCHES

A. Material - Disconnect switches shall be NEMA type HD (Heavy Duty) quick-make, quick-break disconnect switches not furnished by others with equipment and where indicated on drawings or where required by Code. Switches shall be fusible or non-fusible as called for or as required. Switches shall have NEMA I enclosure unless otherwise specified or called for otherwise on drawings. Switches shall have door interlock and shall be padlockable in "open" and "closed" position. Where
indicated for use in motor circuits utilizing VSDs switch shall be furnished with interlock contacts for interface with VSD, preventing operation of VSD when load is disconnected.

B. Reference E-series drawings and Division 26 for disconnect switches provided by electrical contractor. If not shown and required it is assumed the equipment manufacturer is providing it. If not, the contractor shall be responsible for all providing including all labor for installation.

2.6 MOTOR STARTERS

A. Starters shall be in accordance with NEMA ICS, UL 508 and the following paragraphs:

B. All starters installed indoors shall be in a NEMA 1 enclosure and all starters installed outdoors shall be in a NEMA 4 enclosure. Enclosures shall be designed for surface mounting unless otherwise indicated.

C. Each starter shall have a nameplate on the cover. Nameplates shall be made of laminated black and white plastic with the white on the outside. Lettering shall be bold, not less than 1/4 inch square, engraved through the white outside layer so that the letters appear black. Nameplate wording will be furnished as called for on drawings or as approved by the Owners Representative.

D. Magnetic starters shall include 480 volt, 3-phase, 60 hertz contractors with three manual reset thermal overload relays, 120 volt operating coils, and 480 to 120 volt dry type control transformers complete with one secondary lead fused and the other secondary lead grounded. Large size starters which require line voltage to energize the operating coils shall be equipped with auxiliary contractors for use in the operating coil circuit. These contractors shall be operated from the 120 volt circuit of the control transformers. Reduced voltage starters shall be closed transition auto transformer type equipped with taps for 50, 65 and 80 percent of full voltage. Two speed starters and reversing starters, shall be mechanically and electrically interlocked so that only one set of contacts can be closed at any one time. Contractors shall have a current rating in accordance with NEMA standard ICS.

E. Two each normally open and normally closed interlock contacts shall be furnished with each starter as indicated. Additional interlocks shall be as called for on drawings.

F. Three thermal overload relays of the bimetallic strip or euthenic alloy type shall be furnished with each motor starter. Thermal overload relay heaters shall be sized to protect their associated motors of the circuits from damage due to overload. Provisions shall be made for manually resetting the thermal relay without opening the starter cover.

G. Control Transformers shall have 60 hertz ratings permitting operation at a primary voltage ranging from 208 to 240 volts. Assuming 208 volts on the primary terminals, each control transformer shall maintain a minimum potential of 105 volts at its secondary terminals during starter coil inrush, while simultaneously serving an additional load of 100 volt amperes at 50 percent power factor. Control transformers shall be mounted in the enclosure with the magnetic starter.

H. Each magnetic starter shall be equipped for control from local remote push-button or control switch, or other pilot devices as called for on drawings. All necessary internal wiring for this feature shall be supplied and connected to terminal blocks located to provide easy connection to the external control wiring.

I. A push to test running pilot light shall be provided and mounted in the cover of each magnetic starter to indicate when the motor is in operation. The light shall be of the transformer type with a 6 volt bulb and a red color cap.

J. "Hand-Off-Auto" Selector Switch Units shall be provided and mounted in the cover of the starter as indicated in these specifications and as indicated on drawings. Units shall be heavy-duty, oil-tight
and shall be complete with contact blocks and legend plates. Momentary contact "start-stop" push-buttons shall be provided with an auxiliary contact for use in the holding circuit.

K. Schematic Diagrams shall be as indicated on drawings or as approved by the Contracting Officer.

L. Each combination starter where indicated on drawings shall include a magnetic starter, as specified hereinbefore, and a disconnect switch or a fusible disconnect switch complete with fuses.

1) Each fusible disconnect switch unit shall include one 3 pole, 600 volt, quick-make, quick-break, manually operated switch connected in series with one replaceable dual element fuse per switch pole. The switch and fuse elements shall be sized according to the following:

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<thead>
<tr>
<th>Starter Size</th>
<th>Fuse Clip Size</th>
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<td>30 ampere</td>
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<td>0</td>
<td>30 ampere</td>
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<td>1</td>
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<td>100 ampere</td>
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<td>200 ampere</td>
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<td>400 ampere</td>
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M. Fuses shall be UL 198D Class K5, 600 volt, and dual element type. Fuses shall have a thermal element that restricts the temperature rise to 280° F. and an element of low peak type that limits the let through fault current. Fuses shall be rated at 200,000 amperes RMS symmetrical interrupting capacity and shall have a minimum time delay of 10 seconds at 500% of rating as specified hereinbefore.

N. A manual operating handle shall be mounted in the cover of each starter to operate the disconnect switch. The handle shall have provisions to lock in the open position with one or more padlocks. The cover and switch shall be interlocked so that the cover cannot be opened normally when the switch is in the closed position. Provisions shall be made for overriding this interlock.

O. Motor starters shall be wall or column mounted not more than six feet above the floor or mounted on the equipment if readily accessible from the floor or roof. Each starter shall be labeled on the cover as specified hereinbefore. The labeling shall be done with black letters on a white background. Letters are to be 1/4 inch high.

P. Nameplates - All major equipment items shall have a permanent stainless steel nameplate. Nameplates shall include the applicable items in the following list:

1) Manufacturer’s size and type
2) Serial number
3) Design capacity
4) Design pressure
5) Design speed
6) Design temperature
7) Design static pressure “w.c.”
8) Motor horsepower and RPM

Q. A permanently attached rotation arrow shall be provided on all items of rotating equipment.
PART 3. EXECUTION

3.1 CUTTING AND PATCHING

A. The responsibility for any cutting of construction, which is required for the installation work, shall be by the Contractor. The Contractor shall coordinate with the Owner before any cutting and obtain approval from the Engineer and the Owner prior to any cutting.

B. Where openings for work within this Division are provided under other sections of the specifications, this Contractor shall be responsible for locating and providing the proper dimensions for all such openings.

C. Cutting shall be done with extreme care and in such a manner that the strength of the structure will not be endangered. Wherever possible, openings in concrete or masonry construction shall be by concrete saw or rotary core drill. Openings in any construction shall be cut the minimum size required for the installation of the work.

1) Adequate protection shall be provided to prevent damage to adjacent areas and to prevent dust from spreading to adjacent areas.

2) The use of jackhammers will not be permitted.

D. Where openings or holes are cut in existing construction and the cutting breaks existing electrical circuitry or control circuitry, or communications, conduit and wiring, then it shall be the responsibility of the Contractor to have the circuitry, conduit and rewiring re-routed and to complete the circuitry as required and as approved by the Owner. Temporary completion shall be provided where necessary before the permanent re-routing and completion work is finished. All costs for this work shall be the responsibility of the Contractor and no additions will be allowed to the Contract price.

E. Before any cutting, patching, or finishing work is started, dust and moisture protection shall first be installed as required to protect adjacent construction and equipment and to prevent dust spreading from the immediate area where work is being performed.

F. After any work is installed through any opening in walls, partitions, ceilings, or floors, the opening around the work shall be patched to match the existing construction, and the openings around pipe sleeves, and between pipes and sleeves, shall be sealed watertight through floors and shall be sealed fireproof and smoke tight through floors, walls, partitions and ceilings.

G. Where existing work is removed from openings in existing construction and the opening is not to be reused for new work, the opening shall be filled and patched to match existing adjacent construction and to be watertight for floors and to be fireproof and smoke tight for floors and all other construction.

H. No structural member shall be cut without the approval of the Consultant, and all such cutting shall be done in a manner directed by him.

3.2 EXCAVATION AND BACKFILL

A. Work shall be performed as hereinafter specified and in accordance with the requirements of Division 31 and / or Division 33. Soil stabilization shall also be in accordance with Division 31 and / or Division 33.

B. Lines shall be used to layout the trenches for all underground work and there shall be no variation from the drawings except upon written order from the Engineer. Trenches close to walls, foundations, and columns shall not be excavated without prior consultation with the Architect or Owner or his Representatives.
C. All excavations shall be properly protected by the necessary bracing and timbers to prevent any collapses or damage to adjacent improvements. Where required to prevent collapses, the sides of the trenches shall be securely held by bracing or sheathing, which bracing or sheathing shall not be removed until the level of the backfill has reached the point where such removal can be safely carried out. Where adjacent improvements might be damaged by the removal of such bracing, the braces shall be left in place to prevent such damage. The thickness of the sheathing and the dimensions of the cross braces, shoes and miscellaneous supports to be used by the Contractor shall be as required and of type to properly protect the sides of the trench and to prevent injurious collapses or erosions.

D. The Contractor shall do all pumping and bailing necessary to keep all excavations free of water and shall provide for the uninterrupted flow of the surface water adjacent to the line of work during the progress of the work. The Contractor shall inspect the ground where excavation is required to ascertain the structure of the soil.

E. The Contractor shall cut and replace all existing walks, roads, street pavement, curbs, steps, retaining walls, and miscellaneous work removed or damaged by him in connection with the piping installation, whether or not the improvement is shown on the drawings. Such repairs shall be done to the satisfaction of the Architect, and where the work is performed on public property outside of the property lines, the Contractor shall obtain permits and permission from the proper authorities, shall perform all work to comply with requirements of the enforcing authorities and shall pay all costs relating to this work as a part of the contract bid price.

F. In cases where existing water, sewer, gas, electric or other pipes or conduits are encountered, they shall not be displaced or molested unless necessary, in which case, they shall promptly be replaced in good condition. All water, sewer, gas, conduits, or electric lines damaged or molested in the construction shall be replaced or repaired at the Contractor's expense. Wherever necessary to determine the locations of existing underground utilities, pipes, conduits, cables or other structures, examine all available records and make explorations and excavations as necessary to determine the locations.

G. The Contractor shall provide all temporary bridges, barricades, lanterns and such other signs and signals as shall be necessary to warn the public of the dangers caused by excavations and other obstructions.

H. The backfilling of trenches shall be carried out as rapidly as the testing and acceptance of the finished sections of the piping installation will permit. The trench shall be backfilled in layers not to exceed 6" with good selected dry earth thoroughly tamped with pneumatic tamper. Note: Broken stones, cinders, frozen earth and rubbish are not acceptable for backfilling. Before backfill operations commence on any new or replacement underground utility construction work, the Contractor shall give 48 hour notification to the Architect. Such notice shall be required so that the work can be inspected.

I. After backfilling, all surplus excavated material shall be removed from the grounds, to an authorized disposal site.

J. The work shall be executed so that existing culverts, drains, catch basins, retaining walls, fences or any other permanent structure along and adjacent to the new work are properly protected. The Contractor at his own expense shall repair any damage occurring to these structures.

K. The Contractor shall make a field inspection of the location along which the underground work is to be constructed and note all obstructions and improvements at the surface and overhead, which may affect this method of operation in the construction of these lines. Such overhead wires and underground pipes or conduits, which may be existing or which may be encountered, shall be protected by the Contractor during this construction.
3.3 ELECTRICAL COORDINATION

A. All electrical products and installation used on this project shall conform unless otherwise specifically noted, to applicable standards of the National Electrical Manufacturers Association, NFPA 70, Division 26 of these specifications, and shall also be listed by Underwriter's Laboratories, Inc. and/or other agencies, as required.

B. Electrical power sources and motor connections for all equipment shall be provided as specified within Division 26 of these specifications. All control wiring, safety interlock wiring, and temperature control system wiring required shall be furnished and installed as specified within these specifications. The control wiring shall include the furnishing and installation of all conduit, boxes, fittings, devices, accessories, wire, and connections required for complete and properly functioning systems. All wiring shall be installed in conduit, and all splices and connections shall be made in approved type enclosures or boxes.

1) If motors or controls are not shown on the Electrical Drawings, it has been assumed that these motors and controls have been wired as part of a piece of package equipment, or that control wiring will be run by the Contractor.

C. Reports: The Contractor shall submit to the Engineer, after mechanical systems are completely installed and operating under normal load conditions and prior to final acceptance of the project, four (4) copies of tabulated report on each piece of mechanical equipment motor and motor starter. The tabulated reports shall show the following information:

1) Mechanical equipment identification on which motor and starter is used
2) Motor nameplate horsepower, full load amperes, and voltage
3) Motor nameplate service factor and temperature rise
4) Actual (metered) motor running amperes and voltage
5) Motor starter nameplate: HP rating and voltage
6) Motor starter thermal overload protection unit current rating, manufacturer's name and manufacturer's catalog number marked on thermal units.

3.4 NOISE AND VIBRATION

A. Contractor shall be responsible for the installation of all equipment in such a manner as to control the transmission of noise and vibration from any installed equipment or system, so the sound level shall not exceed NC35, in any occupied space. Contractor shall be responsible for the correction of any objectionable noise in any occupied area due to improperly installed equipment.

3.5 INSPECTION

A. Each bidder shall inspect the site as required for knowledge of existing conditions and failure to obtain such knowledge shall not relieve the successful bidder of the responsibility to meet existing conditions in performing the work under the contract.

B. Where new work cannot be installed without changes in existing plant, facility or systems or where it is indicated on drawings to rework an existing installation, this contract shall include alterations to existing work as required to install new work. Additions to the contract cost will not be allowed because of this Contractor's failure to inspect existing conditions.

3.6 TESTING

A. All electrical equipment furnished under this Division shall be adjusted and tested by this Contractor. Motors and other equipment furnished by others, to which electrical connections are made under
this Division, shall be checked for short circuit and open circuits before energizing. Motors shall be checked for proper phasing and rotation. The thermal overload protection devices shall be checked in all motor starters, and equipment and all protection device size, motor nameplate full load amperage, and voltage rating for protection of the motor shall be listed (include equipment designation, rating of heater, motor nameplate horsepower, full load amps and voltage) and 4 copies of list shall be submitted to the Architect.

B. Mechanism of all electrical equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required. Adjustable parts of all lighting fixtures and electrical equipment shall be checked, tested and adjusted as required to produce the intended performance.

C. Completed wiring systems shall be free from short circuits and after completion, perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.

D. The Contractor shall be held responsible for the operation, service and maintenance of electrical equipment during construction and prior to acceptance by the Owner. All electrical equipment shall be maintained in the best operating condition. Operational failure caused by defective material and/or labor furnished under this Division shall be immediately corrected. Architect shall be immediately notified of any operational failures caused by defective material and/or labor covered under other Divisions or furnished by others.

3.7 START-UP

A. All labor for the installation of material and equipment furnished under this Division shall be done by experienced mechanics of the proper trade and all workmanship shall be first class and in compliance with the specific requirements of drawings and specifications.

B. All material and equipment provided under this Division shall be installed under competent supervisory service furnished by the Contractor. Where necessary, this shall include the services of special erection and operation personnel.

C. The Contractor shall furnish all hoists, scaffolds, staging, runways, tools, machinery and equipment required for the performance of work.

D. Dirt and refuse resulting from the performance of the work shall be removed from the premises daily as required (broom clean) to prevent accumulation and the Contractor shall cooperate in the maintaining of reasonably clean premises at all times.

E. Immediately prior to the final inspection, Contractor shall clean all material and equipment. Dirt, refuse and stains shall be removed from all surfaces and damaged finishes restored to original condition.

3.8 TRAINING

A. The Contractor shall furnish all services as required for adequate verbal and printed instructions to the Owner and the Owner's operating and maintenance personnel for operation and maintenance of all equipment and systems installed under this Division. Three complete copies of service manuals in hardback binder shall be furnished at the end of the project in accordance with the General Conditions of the specifications. The manuals shall include printed operating and maintenance instructions for systems and equipment specified under this Division, all approved shop drawings and all manufacturer printed data.

B. When the work is complete and at a time designated by the Owner's designated Representative, the Contractor shall furnish the services of a qualified instructor to instruct the Owner's personnel in the operation and maintenance of the systems and equipment.
C. The bound copies of the operating and maintenance manuals shall be used during the verbal instructions.

END OF SECTION
SECTION 220501 – PLUMBING PROJECT COORDINATION AND INSTALLATION

PART 1. GENERAL

1.1 VISIT TO SITE OF WORK
   A. Visit site and survey existing conditions affecting work prior to bid. Include necessary materials and labor to accomplish the work, including relocation of existing services and utilities on building site in bid. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interference shall be reported immediately to Owner/Consultant.

1.2 CONTRACTOR’S USE OF PREMISES
   A. Confine operations at site to areas and limits permitted by law, ordinances, permits; Contract Documents and GENERAL CONDITIONS.
   B. Protection and safekeeping of products stored on premises is responsibility of contractor supplying product.
   C. Deliveries and unloading shall be scheduled to prevent traffic congestion blocking of access or interference with Work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.
   D. Contractor shall pay for, or satisfactorily repair, all damages incident to their Work, to sidewalks, streets, other public or private property, or to any public utilities occurring during period of work under this Contract.

PART 2. EXISTING FACILITY REQUIREMENTS

2.1 HAZARDOUS MATERIALS
   A. Submit Material Safety Data Sheets for all materials furnished in this project defined as hazardous by NFPA. All requirements of the Material Safety Data Sheets shall be implemented and followed judiciously when hazardous materials are installed or otherwise used.
   B. All hazardous materials shall be stored and used (mixed, applied, etc.) in strict accordance with the OSHA Standards, Safety Data Sheets and the Owner’s Safety standards.
   C. Refrigerants, nitrogen, welding gas, paints, varnish, volatile oils, etc., shall be stored in a room having good ventilation and containing no other material, or in metal lockers or barrels well away from structures or other combustible materials.

2.2 WELDING AND CUTTING
   A. Special precautions shall be taken to reduce fire hazards where electric or gas welding or cutting work or soldering is done and suitable fire extinguishing equipment shall be maintained near such operations. Before proceeding with any electric or gas welding or cutting or soldering work in or adjacent to the existing building the Contractor shall obtain a permit from either the Engineer or Owner. The permit shall be issued by its authorized supervisor or representative certifying compliance with conditions set out in the permit pertaining to welding and cutting operations.

END OF SECTION
SECTION 220523 – PLUMBING VALVES

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Plumbing Valves:
   1) Ball Valves
   2) Butterfly Valves
   3) Gate Valves (Above Ground)
   4) Globe Valves
   5) Check Valves
   6) Plug Valves

B. Pressure and Temperature Relief Valves

1.2 QUALITY ASSURANCE

A. Valves shall be of the same manufacture throughout, where possible. Manufacturer’s name and pressure rating shall be located on outside of valve.

B. Unless noted otherwise, cut-off valves shall be gate valves or ball valves or butterfly valves. Flow control (balancing) valves shall be ball valves or butterfly valves, except flow setting valves with metering connections shall be installed where indicated by symbol on drawings. Flow setting valves with metering connections, shall be provided and installed in accordance with Section 220524.

C. Cut-off valves used in water and water/glycol systems including chilled, process chilled, condenser, heating and process heating shall be ball valves for 2” size and smaller, and shall be butterfly valves 2½” size and larger. Valves used in steam and steam condensate lines shall be gate valves.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with General Requirements, Division 1, Section 013300, and as follows:
   1) Submit copies of valve ordering schedule for approval before ordering valves.
   2) Submit detailed shop drawings indicating make, model, location, type, size, and pressure rating.

PART 2. EQUIPMENT

2.1 BALL VALVES

A. Ball valves shall be manufactured to comply with MSS SP 110 and shall be 2-piece type. Valves shall be all bronze (B-584 or B-62) with stainless steel ball, full port and shall be designed for 150 PSI, 600 WOG; working temperature range of at least 0°F to 300°F. Ball valves shall be three-section assembly with Double-O ring seal and removable center section with replaceable Teflon, TFE seats. Ball valves shall have blow-out proof stem with high extended stem to provide for insulating, lever handle with vinyl grip and 90° stop on the extended stem. All valve stem housings shall be of length to receive up to 1½” thick insulation and shall have NIB seal valve extension.

B. Ball valves in water piping shall have a bronze body and rated at 150 PSI 600 WOG at 180° F. Seats shall be TFE, EPT or Teflon. Ball and stem shall be chrome platted with Viton or Teflon packing.
Handle shall be steel with non-heating plastic coating. Valves shall be union body with screwed or solder joint ends. Solder joint valves shall be disassembled before soldering, as recommended by the manufacturer.

C. Manufacturer
   1) Ball valve manufacturers for HVAC applications
      (a) Nibco
      (b) Stockham
      (c) Jamesbury
   2) Ball valve manufacturers for plumbing applications
      (a) Ball valves in water piping shall be NIBCO T595-66 or approved equal.
      (b) Ball valves provided in compressed air piping shall be NIBCO T585-70-66 or approved equal.

2.2 BUTTERFLY VALVES (LOW PRESSURE SYSTEMS):
   A. Butterfly valves shall be manufactured to comply with MSS-SP67.
   B. The valve body shall be of ductile iron and suitable for alignment with ANSI class 125/150 pound weld neck flanges, shall be 200 psi bi-directional dead-end Droptite shutoff and shall be of the lug style type. The lug style body shall be drilled and tapped for isolation and removal of downstream piping. The valve body shall have an extended neck of sufficient length such that 2 inch, pre-molded fiberglass insulation and jacketing can be installed up to and around the valve neck. The neck extension shall allow sufficient clearance for valve operator without damage to the insulation.
   C. The valve disk shall be of aluminum bronze construction. The valve stem shall be of 316 stainless steel. The method of attachment to valve stem shall be by self locking stainless steel screws, or press fitted taper pins, or one piece stem with double D design to fit disc. The valve body neck shall have a valve stem bushing to absorb valve stem side thrust and shall have upper and lower RTFE lined stainless steel bearings or RTFE bushings. The valve seat shall be a field replaceable resilient type and shall be of EPDM with a rating of -40°F to 250°F. The seat shall be reinforced.
   D. Valves intended for manual throttling shall be equipped with an infinite position throttling handle for valves 5 inches and smaller. Valves 6 inches and larger shall be equipped with gear operators and adjustable memory stops.
   E. Manufacturer
      1) Keystone HS2
      2) Bray
      3) DeZurik
      4) NIBCO

2.3 CHECK VALVES
   A. Swing check valves in piping 2" and smaller shall be Stockham B-319, or NIBCO T413-Y, bronze, rated at 125 psig-swp and provided with a bronze disc and screwed ends.
   B. Swing check valves in copper tubing may be Stockham B-309, or NIBCO F918-B, bronze, rated at 125 psig-swp and provided with flanged ends.
   C. Swing check valves in piping 2½" and larger shall be Stockham G-931 or NIBCO F918-B iron body, bronze mounted, rated at 125 psig-swp and provided with flanged ends.
D. Checks in vertical piping shall be Jenkins 119, or approved equal, with bronze bodies and bronze
discs guided at top and rated at 150 psig-swp.

2.4 PLUG VALVES

A. Materials: 175 psi, eccentric design, cast iron ASTM A 126 Gr. B body, grooved ends, ductile iron
ASTM A 536 plug encapsulated with a resilient material, self lubricating, multiple packing ring stem
seal, welded in nickel overlay seats, and lever or gear operator.

B. Manufacturers: Stockham, NIBCO or McDonnell.

2.5 PRESSURE & TEMPERATURE RELIEF VALVES

A. Material - Pressure and temperature relief valves shall designed, constructed and rated to ASME
Code. Valves shall have a capacity at pressure indicated on drawings, in Btu's/Hr. of not less than
capacity of units which they protect and they shall have test levers. Extend relief line full size and
end over drain.

B. Manufacturer

1) Watts

2) McDonnell

3) NIBCO

PART 3. EXECUTION

3.1 METHOD OF INSTALLATION

A. Valves shall be installed within each system to provide the required flow control and to provide
isolation for inspection, maintenance and repair of each piece of equipment and each main and
branch service loop. The foregoing shall apply whether or not valves are shown on drawings. Valves
shall also be installed in other locations shown on drawings. Each valve shall be installed so as to be
easily accessible for operation and visual inspection after construction is complete.

1) A union connection shall be installed within two feet and on each end of a screw end valve
(Reference Section 221100 for piping unions). Valves and specialty items shall be rated for not
less than the cold water working pressure and the test pressure specified for each piping system.
SECTION 220529 – PLUMBING SUPPORTS, ANCHORS AND SEALS

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Piping Hangers and Supports

B. Roof Mounted Curbs and Equipment Supports

PART 2. EQUIPMENT

2.1 PIPING HANGERS AND SUPPORTS

A. Provide factory-fabricated horizontal piping hangers, clamps, attachments and supports in compliance with ANSI SP-69 and ANSI SP-89. Select hangers and supports sized to exactly fit pipe size for bare piping, and to exactly fit around pipe insulation with saddle and shield for insulated piping. Hangers in contact with copper pipe shall be copper plated.

B. Unless specified otherwise, pipes shall be hung with malleable iron, split ring hangers or clevis hangers not less than 1/8" thick. Strap type hangers shall not be acceptable. Roller type hangers shall be used where required or shown to allow for movement of pipes by expansion. Hangers shall have rods and turnbuckles of required length. Suspension shall be from suitable steel supports fastened to overhead construction or steel wall brackets. Hangers and supports shall be installed so that pipes are run parallel and evenly spaced.

C. Anchors in concrete construction shall be threaded compound type or Phillips self-drilling type of sufficient size to adequately support the load.

D. Manufacturer:

   1) Hangers and supports:
      (a) Mason Mfg. Co.
      (b) Kindorf Mfg.
      (c) Unistrut Mfg., Inc.
      (d) Fee Mfg.

2.2 ROOF MOUNTED CURBS AND EQUIPMENT SUPPORTS

A. Curbs and equipment supports for roof mounted equipment shall be of monolithic construction, not less than 18 ga. galvanized steel, with continuous welded corner seams, factory installed wood nailer, built-in raised cant of height as required for thickness of roof insulation, and base as required for attaching to the roof structure.

B. Curbs shall be internally insulated with 1½" thick, 3 lb. density rigid glass fiber board and shall have galvanized sheet metal liner. Equipment supports shall have integral base plate, wood nailer, and 18 gauge galvanized steel flashing cap.

C. Curbs and equipment supports shall be of size as required to properly mate with equipment to be mounted on the curbs or supports and shall be designed and constructed to safely support the weight of the equipment. The height of curbs shall be as indicated on drawings, but not less than 13½" high above the roof deck, unless called for or specified otherwise.

D. The curbs and supports shall be securely attached to the roof structure to withstand wind pressures on the vertical surface of the curb or supports and the mounted equipment by wind velocities up to
100 MPH. The complete installation shall be made watertight and shall be coordinated with the roofing installer.

E. Manufacturers:

1) Roof Curbs
   (a) Pate Manufacturing Company: PC-2
   (b) Thycurb
   (c) Custom Curb

2) Equipment Supports
   (a) Pate Manufacturing Company: ES-5A
   (b) Thycurb
   (c) Custom Curb

PART 3. EXECUTION

3.1 METHOD OF INSTALLATION

A. Comply with MSS SP-69 and SP-89 for installation of hangers, supports and anchors. Install hangers, supports, clamps, and attachments directly from building structure complete with inserts, bolts, rods, nuts and washers, and washers, and accessories. Do not use wire or perforated metal to support piping; pipe support from other piping shall not be permitted. Install hangers with minimum ¼" clear space between finished covering and adjacent work. Place hanger within 1 foot of each horizontal elbow. Use hangers vertically adjustable 1½" minimum after piping is erected.

B. Insulated pipe, hangers and supports shall be furnished with ribbed galvanized steel shields of not less than 18 gauge; two-piece pre-molded, high compressive strength, insulation inserts (360° around pipe); and vapor barrier jacket covering the insulation inserts. Inserts shall be constructed of high density, 100 psi, waterproofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.

C. Maximum spacing of hangers and supports shall be in accordance with the following schedule for size of pipe:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Rod Size</th>
<th>Ferrous Pipe</th>
<th>Copper Pipe</th>
<th>Plastic Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>½&quot; &amp; ¾&quot;</td>
<td>¼&quot;</td>
<td>8'-0&quot;</td>
<td>6'-0&quot;</td>
<td>4'-0&quot;</td>
</tr>
<tr>
<td>1&quot; &amp; 1¼&quot;</td>
<td>3/8&quot;</td>
<td>9'-0&quot;</td>
<td>7'-0&quot;</td>
<td>4'-6&quot;</td>
</tr>
<tr>
<td>1½&quot;</td>
<td>3/8&quot;</td>
<td>9'-0&quot;</td>
<td>8'-0&quot;</td>
<td>5'-0&quot;</td>
</tr>
<tr>
<td>2&quot; &amp; 2½&quot;</td>
<td>3/8&quot;</td>
<td>10'-0&quot;</td>
<td>9'-0&quot;</td>
<td>5'-0&quot;</td>
</tr>
<tr>
<td>3&quot; &amp; 4&quot;</td>
<td>5/8&quot;</td>
<td>10'-0&quot;</td>
<td>10'-0&quot;</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>6&quot; to 12&quot;</td>
<td>7/8&quot;</td>
<td>14'-0&quot;</td>
<td>7'-0&quot;</td>
<td></td>
</tr>
<tr>
<td>14&quot; to 18&quot;</td>
<td>1&quot;</td>
<td>20'-0&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D. Hangers for cast iron pipe shall be installed on maximum 5'-0" centers.

E. Supports on masonry walls shall have bolts through wall fastened to suitable steel plate on back of wall. Where required to allow for movement of pipe by expansion due to short hanger rods, pipes shall rest on rollers and covering protection saddles. All piping shall be supported and secured as required to prevent vibration and the transmission of noise and lateral movement.

F. The Contractor shall furnish and install all necessary material, hangers and support including all structural steel members and shapes to substantially support and/or suspend all piping and equipment, in an approved manner. Perforated strap hangers will not be acceptable.
1) Drive screws, pins, studs, etc., which are secured in place by means of explosive force will not be permitted.

2) Except as specifically otherwise approved, no item of equipment shall support any pipe or duct nor shall any item of equipment be supported on any pipe or duct.

G. Hangers shall be provided at every item of equipment and at every change in direction or branch connection to every pipe.

H. All pipes through roof shall be installed with sleeves and openings, and with roof flashing/counterflash assembly or pipe curb assembly as herein specified. The complete installation shall be coordinated with the roofing installer and shall be watertight and weather tight.

I. Sleeves shall be steel pipe and shall be installed for single pipe installation. Openings shall be boxed out for multiple installations. Sleeves for acid waste vent stacks shall be installed as specified under the heading: Sleeves and Openings.

J. Single, un-insulated pipes through roof shall be installed with flashing/counterflashing assembly with four pound seamless lead flashing assembly with 8" high boot and not less than 8" skirt. A conical shaped steel reinforcing boot underneath lead flashing assembly shall also be installed. Cast iron counterflashing fitting with rust-resistant prime coat, of the caulking type to fit over all types of piping, vandal-proof set-screws for anchoring in place, and top annular space for sealant fill shall also be installed for single, un-insulated pipes. Assemblies shall be furnished in sizes to properly fit size of pipe with which they are installed. Flashing assembly shall be designed to fit properly on roofs from level up to 20° pitch. Top of flashing cone shall be sealed before installing counterflash fitting. Annular space in top of counterflash fitting shall be completely filled with epoxy sealing compound.

K. Grouped multiple pipes through roof and insulated pipes through roof shall be installed with factory prefabricated metal curb assembly of unitized construction of not less than 18 ga. galvanized steel with base plate for anchoring to roof deck or roof slab. The cant base for roof insulation thickness shall match the thickness of insulation where it is to be installed. A wood nailer strip shall be installed on top of the curb, and shall have 1½" thickness of 3 lb. density fiberglass insulation on inside, and not less than 11" high from base to top of wood nailer. The curb assembly shall also have an acrylic clad ABS plastic flashing cover with number and size of formed openings as required for the number and size pipes through roof, along with a graduated step neoprene boot for each pipe. A neoprene boot shall be secured around pipe and around formed opening in flashing cover with stainless steel clamps for waterproof connections. Insulation on insulated pipes shall be continuous through the curb, flashing cover, and the neoprene boot. After roofing is flashed up over the curb and secured in place, the ABS plastic flashing cover shall be installed over curb and flash roofing and anchored in place for a watertight and weather tight installation.

L. Furnish and set all boxouts for openings and all sleeves for work to be installed under this division. Sleeves shall be installed for all pipes passing through floors, walls, and partitions. All sleeves shall be set tight in construction, without space between the sleeve and construction. Sleeves through walls and partitions shall be flush at each end and sleeves through floor shall extend 2" above finished floor unless indicated otherwise.

M. Sleeves through concrete slabs, concrete walls, and bearing masonry walls shall be steel pipe of not less than Schedule 30. Sleeves through non-bearing wall and partitions may be Schedule 10 pipe or 22 ga. sheet steel with formed bead on each end.

N. The annular space around bare pipes and pipe insulation on insulated pipes through sleeves shall be packed tightly with mineral wool to prevent transmission of air and sound. Each end of sleeve at floors and through fire-rated walls shall also be sealed with 1" thickness of waterproof and fireproof caulk equivalent to 3M #CP25 fireproofing caulk.
O. Each Contractor shall provide all structural steel and materials necessary to properly support and anchor equipment and lines provided under this contract.

P. All equipment and materials shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and suitable for the service required.

Q. Concrete bases shall be provided where shown on the drawings. Equipment which is to be grouted in place shall be grouted with Embeco or approved non-shrink grout.

END OF SECTION
SECTION 220553 – PLUMBING MECHANICAL IDENTIFICATION

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Mechanical Identification for:
   1) Piping systems
   2) Valves
   3) Equipment
   4) Warning signs
   5) Painting

1.2 SUBMITTALS

A. Submit shop drawings in accordance with General Requirements, Division 1, Section 013300.

B. Submit copies valve schedule for each piping system, typewritten and reproduced on bond paper. Tabulate valve number, piping system, system abbreviation, location of valve and variations for identification. Mark valves which are intended for emergency shut-off and similar special uses, by special "flag", in margin of schedule. Include valve schedules within Maintenance Manuals (Re: 230100) and Division 1.

PART 2. EQUIPMENT

2.1 MECHANICAL IDENTIFICATION MATERIALS

A. Stencils: Fiberboard: ANSI A13.1 letter sizes for piping and similar applications; minimum 3/4" high letters for access door signs and similar operational instructions. Stencil paint: Exterior type black.

B. Valve tags: 19 gauge polished brass, 1-1/4" diameter, stamp engraved black enamel fitted. Valve tag fastener shall be solid brass chain.

   1) At Contractors option, valve tags may be 3/32" thick engraved plastic laminated valve tags, within piping system abbreviation in ¼" high letters and sequenced valve numbers ½" high letters, and with 5/32" hole for fastener. Valve tag shall be white with black lettering.

C. Valve schedule frames: For each page of valve schedule, provide glazed display frame with screws for removable mounting on masonry walls. Frame shall be extruded aluminum with SSB-grade sheet glass.

D. Engraved plastic-laminate signs: Engraving stock melamine plastic laminate; sizes and thicknesses indicated; engraved with engraver's standard letter style of sizes and wording indicated; punched for self-tapping stainless steel fasteners. Laminated signs thickness shall be 1/16" for units up to 20 sq.in. or 8" length and 1/8" for larger units. Laminated tags and signs shall be color coded, conforming to the following color code:

   1) Yellow: Heating equipment and components.
   2) Green: Monitoring (space temperature and humidity)
   3) White: Equipment and components that do not meet any of the above criteria.
   4) Red: Warning or Danger.
PART 3.  EXECUTION

3.1 PIPING IDENTIFICATION

A. Identify piping with stenciled signs and arrows, showing piping service. Locate wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

B. Identify piping near each valve and control device and near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is questionable and near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

C. Identify piping at access doors, manholes and similar access points which permit view of concealed piping and near major equipment items and other points of origination and termination.

D. Piping shall be identified at specified hereinbefore and spaced intermediately at maximum spacing of 50 feet along each piping run. However, reduce spacing to 25 feet in congested areas of piping and equipment.

3.2 UNDERGROUND PIPING IDENTIFICATION

A. During back-filling/top soiling of exterior underground piping system, install a continuous plastic line marker, located directly over buried line at 6” to 8” below finished grade. Where multiple small lines are buried in common trench, and do not exceed overall width of 16”, install single line marker.

3.3 VALVE IDENTIFICATION INSTALLATION

A. Valve tag location: Provide valve tag on all valves, cocks, and control devices in each piping system. List each tagged valve in valve schedule for each piping system. Mount valve schedule frames and schedules in machine room where directed by Owner’s Representative.

3.4 MECHANICAL EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate signs except where lettering larger than 1” is required for proper identification. Locate signs in or near each piece of mechanical equipment and each operation device.

1) Provide plastic laminated signs at main control and operating [valves, pumps, meters, gauges, thermometers, control devices, and sensors].

2) Laminated tags, at a minimum, shall be provided for each piece of equipment scheduled on drawings.

B. All temperature sensors, differential pressure switches, and control devices integrated with the building control systems shall be permanently marked to indicate normal operating points or range for both summer and winter operation. Coordinate with Engineer and Owner prior to marking. In addition, all room sensors shall have laminated tags mounted adjacent to the room sensor on wall or within the cover of the sensor itself. The laminated tag shall indicate the device which the sensor serves.

3.5 WARNING AND DANGER SIGNS

A. Where identifications signs are required to indicate a warning or danger, signs shall be plastic laminated with red background and white lettering. At a minimum warning signs shall be provided as follows:
1) All motor driven equipment that automatically starts shall include a warning sign indicating such. Coordinate wording of danger sign with facility manager.

3.6 PAINTING

A. All exposed steel, including structural members for mechanical equipment, piping, structural steel bases, and all other non-ferrous metals, shall be painted with a high solids epoxy coating manufactured by Ameron - Amerlock-400 or approved equal. Apply epoxy coating in accordance with manufacturers written instructions.

B. All painting that will be exposed to weather shall be painted with Aliphatic Polyurethane manufactured by Ameron - Amersheild or approved equal. All painting shall be applied in accordance with manufacturers written instructions.

END OF SECTION
SECTION 220719 – PLUMBING PIPING INSULATION

PART 1. GENERAL

1.1 DESCRIPTION OF WORK
A. Piping Insulation (Glass Fiber Type)

1.2 RELATED DOCUMENTS
A. American Society for Testing and Materials
   1) Flame Spread: 25 or less; ASTM E84, NFPA 255
   2) Smoke Developed: 50 or less; ASTM E84, NFPA 255

1.3 QUALITY ASSURANCE
A. Insulation shall not be applied until all piping has been tested and approved and thoroughly cleaned. All insulation work shall present a neat appearance with smooth and uniform surfaces. Work done in a slovenly manner will not be acceptable. All insulation joints shall be carefully fitted and tightly butted. All jacket materials shall be neatly applied with smooth surfaces and shall be securely adhered or pasted in place. All seams and joints shall be located so that they are as inconspicuous as possible. Exposed edges and ends of all insulation shall be sealed and finished to provide a complete, unbroken vapor seal. The Contractor shall install insulation to be continuous through pipe sleeves.

B. Failure, due to faulty workmanship or material, of any portion of the installed insulation to perform the function as intended by these specifications, either stated or implied, for a period of one (1) year after acceptance of the project by the Owner, shall be the responsibility of the Contractor and shall be rectified at no additional cost to the Owner. This shall include the loosening of any jacket material, the appearance of condensation on the outside of the insulation, or any other mechanical or thermal failure which affects either appearance or efficiency of installation.

1.4 SUBMITTALS
A. Submit shop drawings for all insulating materials in accordance with Division 1.
B. Shop Drawings:
   1) Submit shop drawings which indicate complete material data, mastics, adhesives, list of materials proposed for this project and indicate thickness of material for individual services.
C. Product Data:
   1) Provide current manufacturer’s data to show compliance with these specifications and governing regulations; include proof of compliance for test products of products for fire and smoke rating, corrosiveness and compressive strength.

PART 2. EQUIPMENT

2.1 PIPE INSULATION (GLASS FIBER TYPE)
A. Material – Pipe insulation including fittings and devices, unless specified otherwise, shall be insulated with 1-piece rigid molded glass fiber, 4 lbs/cu ft density with a K value of 0.22 at 75°F. The insulation shall be suitable for temperatures of –40° to 450°F, and with longitudinal flap, butt joint end strips and factory applied pressure sealing lap adhesive.
B. Manufacturers:

1) Insulation:
   (a) Certain-Teed: CSG Snap-On ASJ-SSL Products
   (b) Knauf: Pipe Insulation
   (c) Manville Corp.: J-M Micro-Lok, 650 APT
   (d) Owens-Corning: One-Piece Fiberglass 25

2) Fitting Covers:
   (a) Certain-Teed: Snap-On Products
   (b) Insul-Coustic: Insul-Sure Heavy Density Birma
   (c) Manville Corp.: Zeston, One Piece Pre-molded
   (d) PVC Cover with Fiberglass Insert.

2.2 PVC JACKETING

A. Provide PVC Jacketing on all pipe insulation located below the ceiling line in non-mechanical spaces. Cover pipe fittings and other equipment from an outside diameter of 1-5/8” to 24” in accordance with ASTM C-585.

B. PVC jacketing material shall be gloss white outdoor and spray down weatherable. Fittings, unique shapes fit screwed, welded and flanged elbows, tees, valves, couplings, laterals, reducers and end caps. The Jacketing shall be 0.020” minimum thicknesses. The Jacketing and Fitting Covering Systems include solvent weld adhesives, stainless steel tack fasteners, silicone caulking and adhesive tapes. A die-cut multi-temperature fiberglass insulation insert is available and sized for a full insulation over the exposed pipe fitting and under the overlay of the PVC Fitting Cover.

1) Code Compliance: PVC Fitting Covers and Jacketing meet: Military Specification LP-1035A, Type 11 Grade GU and Type 111, and LP-535E, Type 11 Grade GU and Type 111. Federal Specification HH-I-558, Form B, Type 1 Class B. Requirements of USDA and FDA for use in facilities of the food processing, beverage and pharmaceutical industries. PVC jacketing 25/50 fire class per ASTM E-84. Thermal conductivity of 0.26 BTU/hr/sq ft/°F/In

2) The system shall have an applicable temperature range of -35°F to 500°F (-37°C to 260°C).

PART 3. EXECUTION

3.1 METHOD OF INSTALLATION

A. Systems shall be completely covered throughout, including valves, fittings and accessories. Strainer covers and valve bonnets shall be accessible for maintenance. Unless specified otherwise, insulation shall extend continuous through sleeves. Where pipe covering terminates at ceilings, wall and equipment, furnish and install covering protector cups fastened to covering. Cups shall be Zeston polyvinyl chloride (PVC), or approved equal.

B. All adhesives, tape and any other material used for sealing shall be applied in strict accordance with manufacturer’s instructions which includes covering rate of application, method of application, temperature limits for application of said materials, or any other condition affecting efficiency or permanence of the installation.

C. Where pipe hangers are present, insulated pipe shall be furnished with ribbed galvanized steel shields of not less than 18 gauge, two-piece pre-molded, high compressive strength, insulation inserts (360° around pipe), and vapor barrier jacket covering the insulation inserts. Inserts shall be constructed of high density, 100 psi, waterproofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.
D. Service access shall be provided through insulation where required. Insulation at flanged joints shall be designed to permit removal of flange bolts and nuts. Insulation for removable flanges of cold pipe strainers shall be fabricated with built-up sections of fiberglass pipe covering arranged to facilitate servicing of the strainer. Applications shall be complete with vapor seals.

3.2 PIPE INSULATION (GLASS FIBER)

A. Installation shall be in strict accordance with the manufacturer's instructions. Jacket shall have finish so as not to require field painting, but shall be suitable for field painting if desired.

B. Fittings, valves and accessories shall be insulated with PVC fitting covers with glass fiber inserts to provide same insulating values as the pipe insulation in locations where piping is exposed to view. Strainer covers and valve bonnets shall be accessible for maintenance. Fitting covers on "cold" pipe requiring vapor barrier jackets shall be installed vapor tight using adhesive and "Z"-tape applied to the circumferential joints, overlapping the fitting cover and adjacent insulation jacket. No tacks shall be used on vapor tight fitting covers.

C. Where piping is concealed by construction, the fittings, valves, and accessories shall be insulated with PVC covers as specified for exposed piping. Strainer covers and valve bonnets shall be accessible for maintenance.

D. Use of staples is prohibited, except staples may be used in the longitudinal joints. If after staples are installed, the entire longitudinal joint shall be covered with 3" wide adhesive backed strip to match insulation jacketing to cover staples and securely attached.

E. Piping to be insulated and thickness of insulation shall be as follows:

<table>
<thead>
<tr>
<th>Piping System</th>
<th>Pipe Sizes</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Cold Water &amp; Hot Water</td>
<td>Thru 2&quot;</td>
<td>1&quot;</td>
</tr>
<tr>
<td></td>
<td>2½&quot; &amp; Larger</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>Roof Drain</td>
<td>All</td>
<td>1&quot;</td>
</tr>
<tr>
<td>Refrigerant piping (ACR)</td>
<td>All</td>
<td>1 ½&quot;</td>
</tr>
</tbody>
</table>

3.3 ACCESSORIES

A. Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers recommended by insulation manufacturer for application indicated. Do not use staples on cold water insulation. Provide adhesives, cements, sealers, mastics and protective finishes recommended by insulation manufacturer for application indicated.

3.4 OUTDOOR PROTECTION

A. All outdoor insulation shall be covered with a weather protective jacket consisting of 22 gage aluminum or 26 gage stainless steel protective covering. Edges of exterior jacket shall be securely closed around insulation to prevent rain, snow, dirt, etc. from damaging the underlying insulation in any fashion.

END OF SECTION
SECTION 221116 – DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
   2. Specialty valves.
   3. Flexible connectors.
   4. Water meters furnished by utility company for installation by Contractor.
   5. Escutcheons.
   6. Sleeves and sleeve seals.

B. Related Section:
   1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions as required per local authority.

1.3 SUBMITTALS

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

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Material Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.
   4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint Fittings:

2.3 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
   1. Description:
      a. Pressure Rating: 150 psig at 180 deg F.
      b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Description:
      a. Factory-fabricated, bolted, companion-flange assembly.
      b. Pressure Rating: 150 psig.
      c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
   1. Description:
      a. Nonconducting materials for field assembly of companion flanges.
      b. Pressure Rating: 150 psig.
      c. Gasket: Neoprene or phenolic.
      d. Bolt Sleeves: Phenolic or polyethylene.
      e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:
   1. Description:
      a. Galvanized-steel coupling.
      b. Pressure Rating: 300 psig at 225 deg F.
      c. End Connections: Female threaded.
      d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:
   1. Description:
      a. Electroplated steel nipple complying with ASTM F 1545.
      b. Pressure Rating: 300 psig at 225 deg F.
      c. End Connections: Male threaded or grooved.
      d. Lining: Inert and noncorrosive, propylene.
2.5 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
   2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
   3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
   2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
   3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.6 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.
D. One Piece, Stamped Steel: Chrome-plated finish with spring clips.
E. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.
F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, spring clips.
G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.7 SLEEVES

A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with setscrews.

2.8 SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.9 GROUT
B. Characteristics: Nonshrink; recommended for interior and exterior applications.
C. Design Mix: 5000-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION
A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
E. Install shutoff valve immediately upstream of each dielectric fitting.
F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
I. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices as required by local authority.
J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
M. Install piping adjacent to equipment and specialties to allow service and maintenance.
N. Install piping to permit valve servicing.
O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

P. Install piping free of sags and bends.

Q. Install fittings for changes in direction and branch connections.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

T. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

U. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

### 3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

E. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
   1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
D. Install flow control valve in each hot-water circulation return branch and discharge side of each pump and circulator. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.4 DIELECTRIC FITTING INSTALLATION
A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
B. Dielectric Fittings for 2 inches and Smaller: Use dielectric couplings or nipples.
C. Dielectric Fittings for 2.5 inches and larger: Use dielectric flanges.

3.5 FLEXIBLE CONNECTOR INSTALLATION
A. Install flexible connectors in suction and discharge piping connections to each domestic water pump.
B. Install bronze-hose flexible connectors in copper domestic water tubing.
C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.6 HANGER AND SUPPORT INSTALLATION
A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
   1. Vertical Piping: MSS Type 8 or 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   3. Base of Vertical Piping: MSS Type 52, spring hangers.
C. Support vertical piping and tubing at base and at each floor.
D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 0.375-inch.
E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 and Smaller: 60 inches with 0.375-inch rod.
   2. NPS 1 and NPS 1-1/4: 72 inches with 0.375-inch rod.
   3. NPS 1-1/2 and NPS 2: 96 inches with 0.375-inch rod.
   4. NPS 2-1/2: 108 inches with 0.5-inch rod.
   5. NPS 3 to NPS 5: 10 feet with 0.5-inch rod.
   6. NPS 6: 10 feet with 0.625-inch rod.
F. Install supports for vertical copper tubing every 10 feet.
G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4 and Smaller: 84 inches with 0.375-inch rod.
   2. NPS 1-1/2: 108 inches with 0.375-inch rod.
   3. NPS 2: 10 feet with 0.375-inch rod.
   4. NPS 2-1/2: 11 feet with 0.5-inch rod.
   5. NPS 3 and NPS 3-1/2: 12 feet with 0.5-inch rod.
6. NPS 4 and NPS 5: 12 feet with 0.625-inch rod.
7. NPS 6: 12 feet with 0.75-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer’s written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
   2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
   4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Escutcheons for New Piping:
   1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
   2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
   3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
   4. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.9 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Permanent sleeves are not required for holes formed by removable PE sleeves.

D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

E. Install sleeves in new partitions, slabs, and walls as they are built.
F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.

G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.

H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.

I. Seal space outside of sleeves in concrete slabs and walls with grout.

J. Install sleeves that are large enough to provide 0.25-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

K. Install sleeve materials according to the following applications:
   1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
   2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
      a. Extend sleeves 2 inches above finished floor level.
      b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
   3. Sleeves for Piping Passing through Gypsum-Board Partitions:
      a. Steel pipe sleeves for pipes smaller than NPS 6.
      b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
      c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
   4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
   5. Sleeves for Piping Passing through Exterior Concrete Walls:
      a. Steel pipe sleeves for pipes smaller than NPS 6.
      b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
      c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.

L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.10 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
3.11 IDENTIFICATION
A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

3.12 FIELD QUALITY CONTROL
A. Perform tests and inspections.
B. Piping Inspections:
   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
   3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
C. Piping Tests:
   1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   5. Repair leaks and defects with new materials and retset piping or portion thereof until satisfactory results are obtained.
   6. Prepare reports for tests and for corrective action required.
D. Domestic water piping will be considered defective if it does not pass tests and inspections.
E. Prepare test and inspection reports.

3.13 CLEANING
A. Clean and disinfect potable and non-potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three (3) hours.

   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

   1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
   2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116
SECTION 221119 – DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:
   1. Vacuum breakers.
   2. Balancing valves.
   3. Temperature-actuated water mixing valves.
   4. Strainers.
   5. Drain valves.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Field quality-control test reports.
C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cash Acme.
      b. Conbraco Industries, Inc.
      c. FEBCO; SPX Valves & Controls.
      d. Rain Bird Corporation.
      e. Toro Company (The); Irrigation Div.
      g. Zurn Plumbing Products Group; Wilkins Div.

B. Hose-Connection Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cash Acme.
   b. Conbraco Industries, Inc.
   c. Prier Products, Inc.
   e. Woodford Manufacturing Company.
   f. Zurn Plumbing Products Group; Light Commercial Operation.
   g. Zurn Plumbing Products Group; Wilkins Div.

2.2 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Leonard Valve Company.
      c. Powers; a Watts Industries Co.
      d. Symmons Industries, Inc.
   3. Type: Exposed-mounting, thermostatically controlled water mixing valve.
   5. Connections: Threaded union inlets and outlet.
   6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
   7. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
   8. Reference drawings for temperature, flow and pressure requirements.

2.3 STRainers FOR DOMESTIC WATER Piping

A. Y-Pattern Strainers:

2.4 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AMTROL, Inc.
      b. Josam Company.
      c. Sioux Chief Manufacturing Company, Inc.
      e. Tyler Pipe; Wade Div.
      f. Watts Drainage Products Inc.
      g. Zurn Plumbing Products Group; Specification Drainage Operation.
   3. Type: Metal bellows.
   4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two (2) pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
   3. Do not install bypass piping around backflow preventers unless otherwise indicated.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and water regulators if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each control valve and pump.

G. Install water hammer arresters in water piping according to PDI-WH 201.

H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:
   1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119
SECTION 221316 – SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.

B. See Division 22 Section "Chemical-Waste Systems" for chemical-waste and vent piping systems.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1.3 SUBMITTALS

A. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.


PART 2 - PRODUCTS

2.1 PIPING MATERIALS


B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
   1. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
   2. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
      a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

3.2 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."

F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if (two) 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 VALVE INSTALLATION

A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
   1. Use gate or full-port ball valve for piping NPS 2 and smaller.
   2. Use gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
   1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
   2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
   3. Install backwater valves in accessible locations.
   4. Backwater valves are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.4 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs: According to the following:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 0.375-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 60 inches with 0.375-inch rod.
   2. NPS 3: 60 inches with 0.5-inch rod.
3. NPS 4 and NPS 5: 60 inches with 0.625-inch rod.
4. NPS 6: 60 inches with 0.75-inch rod.
5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4: 84 inches with 0.375-inch rod.
   2. NPS 1-1/2: 108 inches with 0.375-inch rod.
   3. NPS 2: 10 feet with 0.375-inch rod.
   4. NPS 2-1/2: 11 feet with 0.5-inch rod.
   5. NPS 3: 12 feet with 0.5-inch rod.
   6. NPS 4 and NPS 5: 12 feet with 0.625-inch rod.
   7. NPS 6: 12 feet with 0.75-inch rod.

I. Install supports for vertical steel piping every 15 feet.

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

B. Connect drainage and vent piping to the following:
   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
   4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
   1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.

3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316
SECTION 221319 – SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.
   2. Floor drains.
   3. Roof flashing assemblies.
   5. Flashing materials.

1.2 SUBMITTALS
A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE
A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS
A. Exposed Cast-Iron Cleanouts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      c. Tyler Pipe; Wade Div.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Size: Same as connected drainage piping
   3. Body Material: [Hub-and-spigot, cast-iron soil pipe T-branch] [Hubless, cast-iron soil pipe test tee] as required to match connected piping.
   4. Closure: [Countersunk] [Countersunk or raised-head] [Raised-head], [brass] [cast-iron] [plastic] plug.
   5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Sioux Chief Manufacturing Company, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
2. **SANITARY WASTE PIPING**

2.2 **FLOOR DRAINS/FLOOR SINKS**

A. **Cast-Iron Floor Drains:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   
   b. Prier Products, Inc.

C. **Cast-Iron Wall Cleanouts:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.

3. Size: Same as connected drainage piping.

4. Body: [Hub-and-spigot, cast-iron soil pipe T-branch] [Hubless, cast-iron soil pipe test tee] as required to match connected piping.

5. Closure: [Countersunk] [Countersunk or raised-head] [Raised-head], [drilled-and-threaded] [brass] [cast-iron] plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.


8. Wall Access: [Round] [Square], [nickel-bronze, copper-alloy, or stainless-steel] wall-installation frame and cover.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Light Commercial Operation.
g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Equivalent to J. R. Smith Model 2010-A.
3. All floor drains in finished areas shall be chrome plated. Provide each drain that does not have an integral p-trap with a cast iron p-trap in connecting piping.
4. Type “A” floor drain shall be J.R. Smith Model 2010-A.
5. Type “B” floor drain shall be J.R. Smith Model 3020-21-F-C drain with nickel-bronze funnel, strainer, seepage control flange and acid-resistant coating.
6. Type “C” floor drain shall be J.R. Smith Model 3020-F-C drain with nickel-bronze top, strainer, seepage control flange and acid resistant coating.

B. Floor Sinks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Prier Products, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Light Commercial Operation.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Floor sink Type “A” shall be J.R. Smith Model 2450.
3. Floor sink Type “B” shall be J.R. Smith, Model 3161Y-NB-F-C, acid resistant coated with removable strainer and seepage control flange. See Architectural plans for floor sink top elevations and floor drainage.
4. Floor sink Type “C” shall be J.R. Smith, Model 3161Y-NB-12-F-C, acid resistant coated with removable strainer, half-grate and seepage control flange. See Architectural plans for floor sink top elevations and floor drainage.
5. Floor sinks shall be as manufactured by Josam, Watt or Zurn.

C. Floor Troughs:

1. Floor trough Type “A” shall be IMC Teddy Model #SFT, 2 inches deep, heavy duty 14 gauge, type 304-18-8 stainless steel, completely welded and coved. All welds shall be ground and polished smooth. Troughs shall have built-in pitch towards waste outlet for complete drainage. Troughs shall be fitted with stainless steel waste cup with removable perforated stainless steel basket to accommodate up to 3-inch waste pipe. Provide size of troughs as noted on drawings. Provide trough grating Model #SSG for all troughs. Grating shall be constructed of Type 304 stainless steel. Grating shall be constructed of 0.1875-inch by 0.75-inch bars, set in a vertical position with open front and back for ease of draining. Bars shall be heliarc welded to 0.375-inch diameter rods, [two (2) rods for troughs up to 15 inches wide, three (3) rods for troughs over 15 inches wide] set 3 inches from each edge. Rods shall run full length of trough. There shall be a maximum of 0.8125-inch clearance between bars to prevent wheels of mobile equipment from becoming welded between the bars. Grating lengths shall be limited to a maximum of 20 inches for ease of handling and for cleaning in dishwasher.

2. Equal floor trough as approved by Engineer.
2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Acorn Engineering Company; Elmdor/Stoneman Div.
      b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 4.0-lb/sq. ft., thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflash fitting.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:
   1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
   2. Size: Same as connected waste piping [with increaser fitting of size indicated].

B. Deep-Seal Traps:
   1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
   2. Size: Same as connected waste piping.
      a. NPS 2: 4-inch minimum water seal.
      b. NPS 2-1/2 and Larger: 5-inch minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:
   1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
   2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:
   1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
   2. Body: Bronze or cast iron.
   3. Inlet: Opening in top of body.
   4. Outlet: Larger than inlet.
   5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:
   1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend [1 inch] [2 inches] above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
   2. Size: As required for close fit to riser or stack piping.
F. Vent Caps:
   1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
   2. Size: Same as connected stack vent or vent stack.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains and floor sinks at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated. Block out floor prior to pouring of concrete and then level floor drain after power is set, remove forms and grout hole level.
   1. Position floor drains and floor sinks for easy access and maintenance.
   2. Set floor drains and floor sinks below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 0.25-inch total depression.
      b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
      c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
   3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
   4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

I. Assemble open drain fittings and install with top of hub 2 inches above floor.

J. Install deep-seal traps on floor drains and other waste outlets, if indicated.
K. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.

L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

N. Install vent caps on each vent pipe passing through roof.

O. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
   1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
   2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
   3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
   4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

Q. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319
PART 1. GENERAL

1.1 WORK INCLUDED

A. This Specification, together with the accompanying drawings, is intended to be the means of requiring this Contractor to provide all labor, materials, tools, equipment, services and weather protection required for the complete installation, ready to operate of "Plumbing Work" as shown on the drawings and specified herein.

B. Furnish and install as shown on the drawings and as specified herein.

1) Sanitary Drainage System consisting of all piping, floor drains, hub outlets, plumbing fixtures and trim, cleanouts, vents, etc..

2) Domestic Cold Water Supply System consisting of all piping, backflow preventers, pressure reducing valves, flow meters, valves, insulation, hose bibbs, thermal expansion absorber, etc., and connect as shown on the drawings and as required. Extend to all plumbing fixtures, and equipment requiring water.

3) Hot Water Supply System consisting of all piping, valves, pressure and temperature relief valves, temperature control valves, insulation, etc., extend and connect as shown on drawings, to all plumbing fixtures, and equipment as required.

4) Hot Water Recirculating System consisting of all piping, balancing valves, air vents, circulating pumps, temperature controls, miscellaneous valves, insulation, etc., and connect as shown on drawings and as required.


6) Waste Systems
   (a) Clearwater waste systems consisting of all piping, including HVAC condensate, untreated cooling tower water, and ice machine discharge, complete with cleanouts, hub outlets, traps, etc., and connecting to existing system as shown on drawing, per approval of local administration. Discharge must exclude sanitary flow.
   (b) Relief Valves Discharge piping to direct discharge from relief valves to a drain or location in which scalding hot water is unlikely to strike people and discharge without property damage due to flooding.

7) Storm Drainage Systems
   (a) Drainage systems work shall consist of coordination of locating all aboveground and underground piping, drains and pipes passing through walls and roofs.
   (b) Roof drainage, consisting of locating, setting and flashing roof and overflow drains sumps, installation and connecting of roof drains, overflow drains, horizontal downspout and leaders, cleanouts, and coordinate installation with roofing contractors.
   (c) Overflow drains shall be piped separately from the primary system to a separate disposal point so that blockage of the primary drainage will not affect the effectiveness of the overflow drainage system. Means for disposal of the overflow drain discharge must meet the requirements of the local codes. Open discharge on the street may not be allowed, especially in northern climates.
   (d) Site drainage, consisting of location and installation of area drains, footing drainage, sump drains and pumps, inlets, catch basins, manholes and cleanouts.

8) Building Drains
(a) Floor Drains - Furnish and install all work incidental to the foregoing items to be performed under this contract, such as:
(b) All plugged tee and valved outlets
(c) All cutting and patching of work of any nature unless otherwise specified herein
(d) All pipe and equipment hangers, platforms, support bases, anchors, guides, expansion loops, vibration eliminators, etc., unless otherwise specified herein
(e) All required final connections to equipment
(f) All cleaning, disinfecting and testing

1.2 REGULATORY REQUIREMENTS
A. The entire plumbing installation shall comply fully with requirements of all applicable State and local laws, codes and ordinances.
B. The work shall also comply with all applicable requirements of the National Fire Protection Association (NFPA), Occupational Safety and Health Act (OSHA), the 2006 Uniform Plumbing Code (UPC), Providing Accessibility and Usage For The Physically Handicapped People (ANSI A117.1) and the Environmental Protection Agency (EPA).
C. A reference to an ANSI or ASTM Standard shall indicate that the article shall conform to that standard in all respects (including material, manufacture, handling, dimensions, and test procedure).

1.3 SUBMITTALS
A. Submit shop drawings in accordance with General Requirements, Division 1, Section 01300, and as follows:
   1) Submit catalog data and descriptive literature, as applicable, for all equipment, fixtures, and specialty items in accordance with the Conditions of the Contract and obtain approval of materials before delivery to job site.
   2) Shop drawings shall be coordinated with equipment supplied by other Contractors and the Owner.
   3) Submit a bound copy of all approved shop drawings, together with complete parts lists and operating and maintenance instructions for all equipment furnished under this Section.

1.4 JOB CONDITIONS
A. Inspect existing site conditions affecting the work before submitting bid.
B. Take all measurements for plumbing work and shop drawings with all other contractors affected and make any necessary offsets required to conceal piping and to clear equipment, structural members and other obstructions.
C. Protect all work, materials, fixtures and equipment from damage. Cap or plug temporary openings. Deliver all work to the owner clean and in perfect condition. Keep work areas clear of debris. Promptly remove waste material from the premises.

1.5 GUARANTEE
A. The contractor guarantees all plumbing work against any defects due to faulty workmanship or material and that all piping is free from foreign material, obstructions, holes or breaks of any nature.
B. The contractor guarantees the proper circulation and/or drainage of fluid in each piping system.
C. Upon written notice from the Architect or Owner, the contractor shall promptly remedy, without cost to the Owner, any defects occurring within a period of one (1) year from the date of final acceptance.

1.6 CLEANING AND DISINFECTING

A. Piping systems shall be cleaned and disinfected as hereinafter specified. All equipment, temporary piping, chemicals, etc., as required shall be furnished by the Contractor.

1) Domestic Water Systems: All system piping and equipment shall be thoroughly and completely flushed with cold city water. Completely drain the systems and fill with a solution of Sodium or Calcium Hypochlorite, 100 parts per million, completely relieve the system of all air. Allow the solution to stand for eight (8) hours and then drain and follow with a clear water flush for a sufficient period of time to remove all traces of hypochlorite odor. Disinfecting chemicals shall not be introduced into existing piping systems.

B. Immediately prior to final inspection the Contractor shall make a final cleanup of dirt and refuse resulting from his work and shall make the premises broom clean. The Contractor shall clean all material and equipment installed under the contract. Damaged finishes shall be touched-up and restored to their original condition.

1.7 PIPING TESTS

A. All piping shall be tested, leaks repaired and systems retested until proven tight before backfilling, concealing or insulating pipe.

1) Test drainage and vent systems with water or air in accordance with requirements of the Uniform Plumbing Code and all applicable local Codes. Water test may be applied to entire drainage systems or sections of systems. All openings shall be tightly closed in section to be tested except at highest opening. All portions of systems shall be subjected to a minimum of 10 feet head of water. Water must have been in the system 15 minutes prior to inspection. Air test in accordance with the Uniform Plumbing Code may be used at Contractor's option.

2) Hydrostatically test entire domestic water system to 100 psig or higher pressure as required by local Code.

3) Work shall include all testing equipment.

PART 2. EQUIPMENT

2.1 CLEANOUTS

A. Cleanout plugs shall be provided as indicated on the drawings and/or where required for ease of rodding. The following model numbers are based on Zurn.

B. Cleanouts shall be the same size as the pipe up to and including 4" and not smaller than 4" on piping larger than 4". Provide cleanout covers for cleanouts which are not accessible.

C. Cleanouts and covers shall be as follows:

1) Cleanout plugs 2½" and smaller shall be ZB-1470-A.

2) Cleanout plugs 3" and larger shall be ZN-1440-A.

D. Plugs for cleanouts shall be bronze and, unless otherwise specified, shall have a lead seal.

E. Provide flashing flanges for cleanout covers in floors above grade and where floors have a membrane.
F. All nickel bronze shall have polished finish.

G. Manufacturer:
1) Zurn
2) Josam
3) Smith
4) Wade

2.2 DRAINS
A. Drains shall be per the on-drawing plumbing fixture schedule, or herein, at contractor's option.
B. Drains shall be manufactured by Zurn or Wade as hereinafter specified, Josam, JR Smith, approved equal.

<table>
<thead>
<tr>
<th>DRAWING I.D.</th>
<th>MODEL NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRFD Flushing Rim Floor Drain</td>
<td>Wade W-9300-93-4 Cast iron flushing rim floor sink, with flange and clamping device, acid resisting enamel interior, 3/4&quot; LPS flushing connection, satin nickel bronze hinged perforated square top grate and with deep seal P-trap. Flushing valves: Delany 538 Concealed, Sloan Royal 110YC Exposed/ Royal 150 Concealed.</td>
</tr>
<tr>
<td>S.D. Shower Drain</td>
<td>Zurn ZN-415 Dura-Coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with &quot;Type B&quot;, (6&quot; round) polished nickel bronze strainer.</td>
</tr>
<tr>
<td>A.D. Area Drain</td>
<td>Zurn Z-550 Medium duty drain of Dura-Coated cast iron body, bottom outlet and 9&quot; slotted anti-tilt grate trap not required.</td>
</tr>
<tr>
<td>F.D. Floor Drain (Unfinished areas, in slab on grade)</td>
<td>Zurn Z-730 medium duty drain of Dura-coated cast iron body with integral double wall trap and side outlet, seepage pan, bronze floor level cleanout and 9&quot; round loose slotted grate.</td>
</tr>
<tr>
<td>F.F.D. Funnel Floor Drain</td>
<td>Zurn-32-[ ] (-7=8-7/8&quot;x3-5/8&quot;x3-3/4&quot; (-9)=6-3/4&quot;x3&quot;x1&quot; high] Oval funnel converting assembly, specify f.d. and funnel assembly of material to match floor drain, with necessary fasteners to secure funnel to strainer, for use with 6&quot; top size or larger.</td>
</tr>
<tr>
<td>F.D. Floor Drain (Finished area in slab on grade)</td>
<td>Zurn Z-453 Dura-coated cast iron body with uniform diameter integral trap, side outlet, seepage pan and adjustable type &quot;B&quot; nickel bronze strainer (minimum size 6&quot;).</td>
</tr>
</tbody>
</table>
R.F.D. Recessed Floor Drain (Slab on grade)  Zurn Z-566-Y 12" Square open top drain, Duro-coated cast iron body with bottom outlet, with suspended cast iron sediment bucket, less grate.

P.D. Pit Drain  Zurn Z-730V-Y with 9" medium duty, Dura-coated cast iron body, integral trap and side outlet, bronze floor level cleanout, backwater valve and sediment bucket.

E.S.F.D. Emergency Shower/Eye-wash Floor Drain  Zurn Z-511-Y-J with 9" diameter top heavy duty, Dura-coated cast iron deep sump body, bottom outlet, seepage pan, combination membrane flashing clamp, heavy duty cast iron grate with sediment bucket.

R.D. Roof Drain  Zurn ZC-100-[RC] Dura coated iron body roof drain with roof sump receiver, under deck clamp, combination membrane flashing clamp/gravel guard, and low silhouette cast iron dome.

F.D. - Floor drain (finished areas, in slab on grade)  ZN-456-1 with minimum 6" nickel bronze strainer, cast iron body with integral "P" trap and nickel bronze cleanout plug.

F.D. - Floor Drain (finished strainer, cast iron)  ZN-415-B with 6" nickel areas, above grade)bronze body and flashing clamp.

R.F.D. - Recessed Floor Drain hooper and  Z-567-12" x 12" with cast (in slab on grade)iron square sediment bucket.

R.F.D. - Recessed Floor Drain (above grade)  Z-610 - with flashing clamp, cast iron body, sediment bucket, less grate.

R.D. - Roof Drain  Z-100-RC with cast iron dome, body and grate, drain receiver, deck clamp, and primary and secondary flashing clamps.

F.D. - Floor Drain (unfinished areas, in slab on grade)  Z-735 with 8" cast iron strainers, cast iron body with integral "P" trap and bronze cleanout plug.

F.D. - Floor Drain (unfinished areas, above grade)  Z-508 with 8" cast iron strainers, cast iron body and flashing clamp.

F.F.D. - Funnel Floor Drain  Same as F.D. except, include Z-414-6 funnel of material to match strainer.
S.D. - Shower Drain  
ZN-415-B with 6” nickel bronze strainer, cast iron body. Flashing clamp for drains above grade.

A.D. - Area Drain  
Z-551 with 9” cast iron strainer and cast iron body  
No trap required

F.R.F.D. - Flushing Rim  
Floor Drain  
Wade W 9306-93-4 with cast iron body, clamping device, acid resisting enamel interior, ¾” flushing connection with satin nickel, bronze, perforated, square, hinged, strainer, with deep seal P-trap and second flushing connection.  
Provide connecting piping

P.D. - Pit Drain  
Wade W9110-17-24 with cast iron body, seepage flange, acid resisting enamel interior, aluminum dome bottom strainer & satin nickel bronze, top grate shall have center hole

C. All floor drains, except where specified with integral traps, shall be provided with separate cast iron traps.
D. All nickel bronze shall have polished satin finish.
E. Drains shall be sized as indicated on drawings.

2.3 FLASHING
A. Contractor shall flash around each vent pipe extending through roof, with 6 lbs. sheet lead. Flashing shall be installed 10 inches in all directions from pipe underneath roofing material and joined with wiped joint to piece of 6 lb. lead soil pipe, carried up, over and turned down into the top of pipe so as to form a permanent watertight joint, and to permit expansion.
B. All lead flashing shall be entirely painted with a good coat of black Asphaltum before installation.
C. Coordinate installation with roofing contractor.

2.4 LEAD SAFE PANS
A. Contractor shall furnish and install for all roof drains, and all clean-out covers and floor drains in floors above grade a 36"x36" 6 lb. sheet lead pan. All surfaces of pans shall be painted with a good coat of black Asphaltum before installation. Lead safe pans shall be watertight.
B. Coordinate roof drain installation with roofing contractor.
2.5 PLUMBING SPECIALTIES

A. Refer to the on-drawing plumbing fixture schedule which govern for models, or where not shown, refer to specifications below.

B. All plumbing specialties shall be furnished and installed per manufacturer’s requirements. All work and material required to rough-in, connect-up and install specialties items shall be provided as required for proper operation. Items are specified by manufacturer’s numbers as to the type and quality required.

C. Provide fixtures as indicated in the on-drawing plumbing fixture schedule or herein.

D. SF-Service Fittings: Chicago Faucet 782-VB-IS chrome plated supply fitting with integral vacuum breaker, ¾” hose outlet, bucket hook, wall brace and integral stops.

E. GPR-Gas Pressure Regulators: Pressure regulating valves shall be of size and capacities indicated on the drawings. Pressure regulators shall be provided with full flow relief vented outside of the building. Gas pressure regulators shall be provided with inlet and outlet pressure gauges. Regulators shall be Rockwell, Fisher, or approved equal.

F. PRV Water Pressure Reducing Valves: Pressure reducing valves shall be a factory set for required pressure and shall be provided with stainless steel or nickel alloy renewable seats, stainless steel strainer screens, high temperature diaphragms, and shall be rated at a minimum of 250 psig-wwp.

G. Valves 2” and smaller shall have bronze bodies with screwed ends, Watts U5 or approved equal.

H. Valves 2½” and larger shall have iron bodies with flanged ends, Watts 1223S, 2230S or 127W or approved equal.

I. Flexible Connections: Flexonics Series 400, or approved equal, braided flexible hose with screwed ends, seamless stainless steel bellows and stainless steel woven braid. Hose shall be of the length and pressure ratings, etc., as required for services and conditions encountered.

J. MV Water Mixing Valves:

1) Valve size and capacity as indicated on the drawings with a maximum pressure differential of 10 psi.

   (a) Powers No. 11 Self-Operating Temperature Regulator or approved equal, three-way automatic valve for mixing domestic hot and cold water to maintain constant, pre-set temperature delivery. Valve shall be complete with sensing element, element well and thermometer at discharge.

   (b) Valves shall have bronze body with composition disc and union connections for sizes through 2”.

   (c) Valve sizes 2½” through 4” shall have iron body, bronze trim and flanged ends.

   (d) Leslie-Eventemp model GTRCK Self-contained Temperature Regulating or approved equal, 250 lb. cast iron body, single seated valve, for mixing cold water into domestic hot water supply to maintain constant, pre-set temperature delivery. Valve shall be complete with calibrated dial, heavy gage copper flexible liquid filled thermo-element tubing, brass element bulb and thermo bulb casing. Provide down-stream thermometer with Ranageability 200-1.

   (e) Leonard Type TM-[ ]-E Thermostat Mixing Valve or approved equal, for exposed piping with corrosion-resistant bi-metal thermostat directly linked to valve porting to control the intake of hot and cold water and compensate for supply temperature or pressure fluctuations, with adjustable limit stops, color-coded temperature scale, wall support, union angle checkouts with removable strainers on inlets, 1/2” tempering circulating by-pass, and rough bronze finish.
K. Thermal Expansion Absorber Tank: Amtrol Model AST Extrol or approved equal for potable water heaters, shall be of the positive fixed diaphragm type, factory pre-charged and field adjustable, with heavy duty Butyl diaphragm rigid polypropylene liner, and rust resistant baked epoxy finish outer shell, complete with NPT system connection and stainless steel air charge valve to facilitate on-site charging. Size and capacity as indicated on the drawings. Tank shall be installed on the cold water side of the water heater, connected between heater and backflow preventer, and charged with air pressure as required by the system operating pressure. Tank shall be ASME constructed and rated for not less than 125 psi working pressure and 200 degree working temperature.

L. P-# Circulating Pump -- Domestic Hot Water: Bell & Gossett bronze body model HV series or approved equal, in-line horizontal, oil-lubricated type. Specifically designed and guaranteed for quiet operation, suitable for 125# working pressure and 225 degrees operating temperature. Motor shall be of the drip-proof, sleeve bearing, rubber mounted construction. Motor shall have built-in thermal overload protection. Pump shall have a capacity of 2 GPM at 15 ft. head when operating at 1750 rpm. 120 volts, single phase, 60 hertz. Circulating pump shall be controlled via of return aquastat.

2.6 PLUMBING FIXTURES

A. Furnish plumbing fixtures as indicated on the on-drawing plumbing fixture schedule.

B. All plumbing fixtures, equipment and related accessories shall be furnished and installed in a neat, finished and uniform manner. All work and material required to rough-in, connect up and install supply, drain, waste, soil and vent piping shall be provided as required for proper operation. This shall include plumbing fixtures, equipment and accessories and includes items furnished under other sections or furnished by the Owner. Fixtures, equipment and accessories are specified by manufacturer's numbers as to the type and quality required. (NOTE: The architect may reject any fixture, equipment item or accessory which, in his opinion is not of the quality or type specified.). Specified manufacturers and approved equal manufacturers are as follows.

<table>
<thead>
<tr>
<th>ITEM OR EQUIPMENT</th>
<th>SPECIFIED MANUFACTURE</th>
<th>APPROVED EQUAL MANUFACTURER</th>
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</thead>
<tbody>
<tr>
<td>Vitreous China Fixtures</td>
<td>Toto</td>
<td>Kohler</td>
</tr>
<tr>
<td>Wall Hung Lavatory</td>
<td>Elijer</td>
<td></td>
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<tr>
<td>Water Closet</td>
<td>American Standard</td>
<td></td>
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<tr>
<td>Urinal</td>
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<td></td>
</tr>
<tr>
<td>Molded Stone Fixtures</td>
<td>Fait</td>
<td></td>
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<tr>
<td>Animal Room Sink</td>
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<td></td>
</tr>
<tr>
<td>Precast Receptors</td>
<td>Fiat</td>
<td>Williams</td>
</tr>
<tr>
<td>Sensor Operated</td>
<td>Just</td>
<td>Bradley</td>
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<td>Sloan</td>
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<td></td>
<td></td>
<td>T&amp;S Brass</td>
</tr>
<tr>
<td>Waste Fittings</td>
<td>McGuire</td>
<td>Dearborn</td>
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<tr>
<td>Stops &amp; Supplies</td>
<td></td>
<td>Brasscraft</td>
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<td>Powers</td>
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<td>Toto</td>
<td>Delany</td>
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<tr>
<td>Trough Washdoen</td>
<td></td>
<td>Sloan</td>
</tr>
</tbody>
</table>

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PLUMBING FIXTURES AND ACCESSORIES
224200 - 8
C. All vitreous china and enameled cast iron fixtures shall be white in color, acid resisting, without blemishes and the best of their respective kind.

D. All stainless steel fixtures shall be 18 gauge, type 302 (18-8) nickel bearing stainless steel, with brushed satin finish and sound deadening undercoat.

E. Plumbing trim utilized shall be provided with renewable seats and replaceable internal working components.

F. Each water closet shall be provided with a seat, seats shall be white, elongated open front, with combination self-sustaining check hinges.

G. Unless otherwise specified, each lavatory shall be provided with: McGuire ST7-LK angle stops and M65 3/8"x12" flexible risers; McGuire 8902 adjustable, semi cast brass P-trap (1¼" inlet, 1½" outlet) with ground swivel joint, cleanout plug, slip inlet and 17 gauge 1½" trap arm. Provide McGuire 158WC loose key straight stop supplies for wheelchair lavatories.

H. Unless otherwise specified, each sink shall be provided with: McGuire ST7-LK angle stops and M66 3/8" x 20" flexible risers; McGuire 151 basket strainer, 1½" x 4" 17 gauge tailpiece with brass locking and coupling nuts, McGuire 8912 adjustable, semi cast brass P-trap (1½") with ground swivel joint, cleanout plug, slip inlet and 17 gauge 1½" trap arm. Provide additional strainers, tailpieces and continuous waste pieces for multiple compartment sinks as required.

I. All fixtures shall be substantially supported in an approved manner. Furnish and install adjustable carriers with legs, floor bases, bearing plates, support arms or rods as required for all wall hung fixtures. Anchor carriers to floor and brace to wall construction for substantial support. Carriers shall be required to fit fixtures furnished. Verify available space for carriers and provide appropriate carrier to fit space and building construction. Install all supports before walls are finished. The Contractor shall be responsible for a period of one year following final acceptance of the building, for the loosening of any plumbing fixture and any subsequent damage to the building caused by the fixture or as a result of leaks in piping, and shall promptly make repairs to the building, shall replace or repair fixture carriers as deemed necessary by the Architect at no additional cost to the contract.
J. All fixtures shall be set true and level. Install all fixtures in accordance with manufacturer’s requirements and at recommended heights unless otherwise indicated.

K. Fixtures that are wall hung or butt a wall shall have adjacent edges and surfaces factory ground true and square.

L. All spaces between fixtures and finished surfaces shall be caulked and pointed square with an approved white silicone sealant resulting in a neat and smooth appearance.

M. All exposed fixture trim shall be polished chrome plated brass.

N. The contractor shall be responsible for the protection and cleanliness of all fixtures, equipment and accessories.

O. Set all countertop fixtures with caulking compound and seal edge of rim with an approved white silicone sealant for a neat, smooth appearance.

P. All precast receptors and basins shall be of standard color and set level in a bed of cement mortar per manufacturers requirements.

Q. All water supply fittings shall close with pressure and have model trim.

R. Refer to the on-drawing plumbing fixture schedule for models, accessories, etc. They govern for bidding.

S. The following fixture and equipment list specifies the basic fixture or item, each of which shall be provided with applicable accessories for its proper operation.

1) Refer to on-drawing fixture schedule.

T. Cafeteria and Restaurant Fixtures

U. Ice Maker rough-in boxes – per on drawing schedule

V. Laundry Equipment rough-in boxes – per on drawing schedule

W. Water Softeners – none this project

PART 3. EXECUTION

3.1 FIXTURE BRANCH PIPING

A. Size piping as indicated on drawings and diagrams but not smaller than indicated in the "Branch Fixture Schedule" below.

1. Connection to individual plumbing fixtures shall be as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Waste</th>
<th>Vent</th>
<th>Cold</th>
<th>Hot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinal</td>
<td>2”</td>
<td>1 ½”</td>
<td>1”</td>
<td>--</td>
</tr>
<tr>
<td>Water Closet</td>
<td>4”</td>
<td>2”</td>
<td>1 ¼”</td>
<td>--</td>
</tr>
<tr>
<td>Lavatory</td>
<td>2”</td>
<td>1 ¼”</td>
<td>½”</td>
<td>½”</td>
</tr>
<tr>
<td>Drinking Fountain</td>
<td>2”</td>
<td>1 ¼”</td>
<td>½”</td>
<td>--</td>
</tr>
<tr>
<td>Janitor Basin</td>
<td>3”</td>
<td>1 ½”</td>
<td>½”</td>
<td>½”</td>
</tr>
<tr>
<td>Shower</td>
<td>2”</td>
<td>1 ½”</td>
<td>½”</td>
<td>½”</td>
</tr>
<tr>
<td>Sink</td>
<td>2”</td>
<td>1 ½”</td>
<td>½”</td>
<td>½”</td>
</tr>
</tbody>
</table>

B. Provide air chambers at all locations where supply pipes terminate. All air chambers shall be full size of supply piping and 15” long except for flush valves shall be 18” long.
C. All exposed connections and fittings shall be chrome plated brass. All supplies, stops, escutcheons, tailpieces, traps and trap arms within cabinets shall be considered exposed.

D. Provide chrome plated cast brass set-screw escutcheons for all exposed fixture supply and waste piping.

E. All fixture supply and waste piping through wall shall be rigidly supported. Supports in contact with copper piping shall be copper plated or fire retardant plastic.

3.2 SHOCK ABSORBERS

A. Shock absorbers: Furnish and install sealed bellows shock absorbers in the water supply to each bank of plumbing fixtures in main toilet rooms as shown on drawings and in make-up water connections where solenoid valves are installed as shown on drawings. Shock absorbers shall be sized and rated for number of fixtures in each bank in accordance with the Plumbing and Drainage Institute (PDI) Standard PDI-WH201.

B. Manufacturers:
   1) Wade: Wade Series W "Shokstop"
   2) Zurn
   3) Josam

END OF SECTION
SECTION 230500 – HVAC GENERAL PROVISIONS

PART 1. GENERAL

1.1 DESCRIPTION OF WORK
A. Provide items, articles, materials, operation and methods required by drawings and specifications including labor, equipment, supplies and incidentals necessary for completion of work in Division 23 – Heating Ventilating and Air Conditioning.

1.2 RELATED DOCUMENTS
A. The General Provisions described herein, together with the conditions of contract, and the General Requirements of Division 1, apply to the work in Division 23 – Heating Ventilating and Air Conditioning.
B. This Section is hereby made a part of all other sections of Division 23 – Heating Ventilating and Air Conditioning, as if repeated in each.

1.3 QUALITY ASSURANCE
A. All permits and licenses that are required by governing authorities for the performance of shall be procured and paid for by the Contractor.
B. All work shall be performed in compliance with all applicable and governing safety regulations including the regulations of the Occupational and Safety Health Act. All safety lights, signs and guards required for performance of work shall be provided by the Contractor.
C. All work shall conform to the requirements of all applicable codes, ordinances and regulations including the rules and regulations of the National Electrical Code, the National Fire Protection Association, the Uniform Mechanical Code UMC, OSHA and all State and Local laws, codes and ordinances.
D. Laws, codes, ordinances and regulations shall take precedent excepting only where the work called for by the drawings and specifications exceeds by quality and quantity.
E. Fixtures, appliances, equipment and materials which are subject to Underwriter's Laboratory tests shall bear such approval.
F. Mechanical and electrical designs are based on the requirements for the specified manufacturers listed on the equipment schedules. Conduit, disconnects, motor starters, breakers, fuses and wire sizes are selected on basis of scheduled equipment. Increased current requirements necessitating larger wire, breakers, switches, etc., to accommodate any alternate or substitute manufacturer’s equipment, other than as shown on drawings shall be provided without any increase in contract price by contractor furnishing the equipment.
G. Manufacturers, where specifically called for, must provide factory tests, unit installation observations, unit start-up and tests, etc., as specified, and submit signed reports to the Engineer upon completion of these services. Subletting of these services will not be permitted. Shop drawing submittals shall be accompanied with a letter of certification by the manufacturer that the specified services shall be provided. Failure to do so shall be cause to reject the shop drawing submittals.
H. The contract drawings are in part schematic and intended to convey the scope of work and indicate the general layout, design and arrangement. The Contractor shall follow these drawings in the layout of his work and shall consult general construction drawings, electrical drawings and all other drawings for this project, and shall verify all existing site conditions to determine all conditions affecting the work shown or specified. The contract drawings are not to be scaled and the Contractor shall verify spaces in which the work is to be installed.
I. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, Engineer shall be notified before proceeding with installation.

J. Work in cooperation with one another to fit piping and ductwork into the structure as job conditions may demand. All final decision as to right of way and run of pipe, ducts, etc. to be made by Engineer or his representative.

K. All work shall be performed by trained mechanics of a particular trade involved and done in neat and workmanlike manner as approved by "Engineer".
   1. Work shall be performed in cooperation with other trades and scheduled to allow timely and efficient completion of project.
   2. Furnish other trades advance information on locations and sizes of frames, boxes, sleeves and openings needed for work, and also furnish information and shop drawings necessary to permit other trades affected to install their work properly without delay.
   3. Where there is evidence that work of one trade will interfere with work of other trades, all trades shall assist in working out space conditions to make satisfactory adjustments.

L. Work installed before coordinating with other trades causing interference with work of such other trades shall be changed to correct such condition without increase in contract price and as directed by Engineer.

M. Where specific details and dimensions are not shown on the drawings, the Contractor shall take measurements and make layouts for the proper installation of the work and coordination with all other work on the project. In case of any discrepancies between the drawings and the specifications, it shall be assumed, by the signing of the Contract, that the higher cost (if any difference in costs) is included in the contract price, and the Contractor shall perform the work in accordance with the drawings or with the specifications, as determined and approved by the Engineer.

N. The Contractor shall be responsible for a scheduled sequence in performing the work so that it will not interfere with the Owner's operation in the existing building. Before any work is started, the Contractor shall consult with the Engineer and Owner and arrange a satisfactory schedule.
   1. Make temporary alterations as required to execute work so that all operations and services in the existing building are maintained with the minimum possible interruption.
   2. Temporary shut-downs shall be segregated and shall be of the shortest possible duration. All facilities shall be kept in continuous operation unless specific permission to the contrary is granted by Owner.

O. Definitions:
   1. "Piping" includes, in addition to pipe, all fittings, valves, sleeves, hangers, and other supports and accessories related to such piping.
   2. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, or in crawl spaces.
   3. "Exposed" means not installed underground or "concealed" as defined above.
   4. The words "furnish and install", "provide", "furnish", "install", or equivalent words are used or are understood, to mean the Contractor shall furnish and completely install the system, service, equipment, or material named, together with other associated devices, equipment, material, wiring, piping, etc. as required for a complete operating installation, and conforming to the manufacturer's standards and recommendations.
   5. It is the intent of these specifications and drawings to call for finished work, tested and ready for operation.
6. All apparatus, appliances, materials or work not shown on drawings, but mentioned in specifications, or vice versa, and/or all incidental accessories necessary to make work complete and ready for operation, even though not specified or shown on drawings, shall be furnished and installed without increase in contract price.

7. Should there be discrepancies or questions of intent, refer matter to Engineer in writing for decision before ordering any equipment or materials or before starting any related work.

1.4 SHOP DRAWINGS AND SAMPLES

A. Shop drawings, project data and samples furnished by the Contractor shall illustrate materials, equipment or workmanship, and establish standards by which the work will be judged.

B. Shop Drawings and Samples shall be submitted to the Engineer by a letter of transmittal. The party making the submission shall be named on Shop Drawing/Sample and also in the letter of transmittal.

C. When Shop Drawing submissions are in the form of loose pages (8½” x 11”) they shall be submitted in sets assembled in portfolio binders showing on the covers or first page inside, a complete list of contents. A minimum of 7 sets of each submission are required, however, additional copies may be requested.

D. The Contractor shall review, stamp with his approval and submit, with reasonable promptness and in orderly sequence so as to cause no delay in the work or in the work of any other contractor, all Shop Drawings and Samples required by the Contract Documents or subsequently by the Engineer as modifications. Shop Drawings and Samples shall be properly identified as specified or as the Architect/Engineer may require. At the time of submission, The Contractor shall inform the Architect/Engineer in writing of any deviation in the Shop Drawings or Samples from the requirements of the Contract Documents.

E. Except in the case of brochures, catalogue cuts and the like, shop drawings shall be in the form of a reproducible print(s) (sepia). In every case, the submittal shall consist of one sepia of each shop drawing and two (2) black line prints of the same. Each print shall be made from the original shop drawing tracing. The transparency shall be capable of producing clean, clear black and white prints.

F. Contractor shall stamp each sepia and black line print (shop drawing) the same. He shall also stamp each brochure, sample and the like. Special Note: Every page with project information shall be stamped. In every instance, the document shall be reviewed by the Contractor and shall also be signed by the Contractor indicating that the document has been reviewed, and that it is approved by the Contractor. The submittals will not be reviewed without the Contractor’s approval stamp and signature.

G. The Contractor’s approval stamp and signature shall signify that the Contractor has checked the submittals. Any submittals which have not been checked shall be returned to the Contractor for checking, approval stamp, signature, and resubmittal for compliance with the contract documents. After review of the submittals they will be returned to the Contractor with one of the following remarks checked:

1. No Exceptions Taken SUBJECT TO CONTRACT DOCUMENTS.
2. Note Corrections SUBJECT TO CONTRACT DOCUMENTS RESUBMISSION NOT REQUIRED.
3. Revise and Resubmit REVISE, RESUBMISSION REQUIRED.
4. Rejected NOT APPROVED.
H. Upon receipt of exhibits submitted and marked for resubmittal the Contractor shall cause the marked corrections, and corrections that may be contained in the Architect/Engineer transmittal letter to be made on each submittal. All such corrections shall be circled, numbered, and dated to permit prompt reviewing upon resubmittal to the Architect/Engineer. Upon receipt of each submittal now marked:

I. The Contractor shall cause submittals to be distributed to the respective contractors and suppliers as is necessary for proper performance of work.

J. At the time of submission, the Contractor shall inform the Engineer in writing of any deviation in the exhibits submitted from the requirements of the Contract.

K. The Engineer's review of exhibits submitted with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the Project and with the information given in the Contract. The Engineer's review of a separate item shall not indicate review of an assembly in which the item functions. The Engineer's review is not intended to indicate approval of dimensions or quantities.

L. Contractor shall make any corrections required by the Engineer and shall resubmit the required number of submittals until further resubmittals are no longer required.

M. Engineer's review of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract unless the Contractor has the Engineer's approval in writing of such deviation at the time of submission and the Owner's Representative has given written notice to the specific deviation; nor shall the Engineer's review relieve the Contractor from responsibility for errors or omissions in the submitted exhibits.

N. No portion of the work requiring a submittal shall be commenced until the Engineer has reviewed the submission. All such portions of the work shall be in accordance with reviewed submittals.

1.5 OPERATION AND MAINTENANCE MANUALS

A. In addition to the requirements specified in Division 1, the Contractor at the project’s completion shall submit a complete system operating and maintenance manual. O&M manual shall be organized into systems and shall contain the manufacturer's complete detailed operating and maintenance instructions with equipment data for each piece of installed equipment furnished under this project. Manual at a minimum shall include the following:

B. Manual shall be composed of typed instructions sheets with large drawing sheets (not reduced) folded in with reinforced margin, shall have a post binder system so that sheets can be easily substituted, and shall have a hard cover.

C. Include in O&M manuals Manufacturers written maintenance instruction for each different piece of equipment provided and installed on this project.

D. Include spare parts list for each major piece of equipment furnished for the project including but not limited to rooftop units, controls, and accessories.

E. Provide a comprehensive list of maintenance procedures for preventative maintenance and troubleshooting; disassembly, repair and reassemble; aligning and adjusting instructions.

PART 2. EQUIPMENT

2.1 GENERAL

A. All materials and equipment shall be new and shall bear manufacturer's name, model number and other identification marking.

B. All materials and equipment shall be standard product of manufacturer regularly engaged in production of required type of material or equipment for at least 5 years (unless specifically exempted by Engineer) and shall be manufacturer’s latest design having published properties.
2.2 EQUIPMENT FURNISHED BY OWNER OR OTHER TRADES

A. Owner furnished equipment includes the following:

1. None

B. General

1. The following paragraphs describe the Contractor’s responsibilities for receiving and installing this equipment after shipment from the Manufacturer. Contractor shall complete all installation in accordance with this and other relevant Sections within this Division.

C. Receiving and Inspection

1. All equipment is shipped F.O.B to the jobsite. All delivery and transportation charges will be prepaid, so that Contractor will not incur additional shipping charges. Upon receipt of equipment, Contractor shall inform Owner/Owner’s Representative and provide a copy of the bill of lading. Maintain delivery records for inventory control and for use in processing payment request vouchers. Crosscheck delivery records with project schedule so as to eliminate work stoppages due to material shortages.

2. The Contractor shall be responsible for coordinating with the manufacturer for installation of the equipment furnished above as shown on drawings. The Contractor shall be responsible for warranty work required and shall coordinate with the manufacturer of the equipment to accomplish warranty work including any labor and additional cost for such warranty work. The Equipment Manufacturer shall provide the Contractor with installation manuals and instructions to the Contractor. The Contractor shall receive and install this equipment for a complete furnished and installed installation including all accessories as specified within these specifications and as shown on drawings.

3. The Contractor shall check equipment and trim delivered to job site by Equipment Supplier against approved shop drawings or other required documentation. The Contractor shall report all discrepancies, shortages, or lack of data to the Owner and Equipment Supplier for adjustments within 1 week after equipment is received. If such report is not made within one week, it shall be assumed no discrepancies, shortages, or lack of data has been found.

4. The Contractor is responsible for off-loading of shipped equipment. Contractor shall handle products, materials, and equipment in accordance with manufacturer’s recommendations and recognized industry standards. Contractor shall utilize lifting lugs, and designated lift points when hoisting equipment. In all cases, Contractor shall carefully handle, transport, and position items to prevent damage during construction.

5. An access restricted area shall be provided for the storage of all supplemental equipment, accessories and materials. This restricted area shall be divided into two distinct areas designated as “quarantined” and “released”. The storage area designated as “quarantined” shall be used to store equipment, materials and accessories prior to inspection and acceptance. Under no circumstances shall an item be removed from quarantined storage until it designated as “released”. After the equipment, material or accessory has been inspected and approved for installation, based on the review of specifications and drawings, the item shall be relocated to the “released” area, where the contractor shall install the unit according to the project schedule.
6. Contractor shall store equipment and components in a manner to prevent damage and degradation. Store items on skids or pallets, elevated above the floor or grade. Store items subject to moisture damage in a dry location. Retain protective shipping covers, crates, and cartons during storage. Protect items from contamination by jobsite dirt and debris and other foreign matter. Provide a secure, fenced and lighted area for outside jobsite storage where required.

7. The Contractor is responsible for inspection and verification of all supplemental equipment. Contractor shall verify all equipment received is properly marked with product names, model numbers, types, grades, compliance labels, and other information needed for identification.

8. Shipment shall be verified in accordance with all data and information on specifications and submittals, including quantities, accessories, sizes, dimensions, utility requirements and general compliance. Contractor is responsible for final dimensions, verification of installation requirements and utility connections, which shall be confirmed at the job site. Contractor shall notify the Owner/Owner's Representative of any deviations from the requirements of the Purchase Order, Drawings, or Specifications.

9. Contractor shall receive and inspect all tanks and agitators. Shipment shall be verified with approved shop drawings, and all attachments shall be accounted for. If any accessory is not received contractor shall notify manufacturer. Contractor is responsible for tracking receipt and storage of all tanks and appurtenances.

10. If, during the course of inspection or installation, any of the goods received are found to be defective in material or workmanship, or otherwise not in conformity with the Purchase Order requirements, the Contractor shall notify the Owner/Owner's Representative, who shall retain the right to reject or revoke acceptance and return the goods. Such goods are not to be repaired, altered or replaced without written authorization from the Owner/Owner’s Representative.

D. Installation

1. Contractor shall verify and integrate the installation of the supplemental equipment with the various elements of the building systems based on their review of latest information provided in the approved submittal data and coordination drawings. Install supplemental equipment to conform with all utility systems, electrical components and controls based on the Construction Drawings and the associated specifications provided. Where coordination requirements conflict with individual system requirements refer conflict to the Owner/Owner’s Representative.

2. If greater capacity or more materials or labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then it shall be the responsibility of the parties involved in providing the substitute and/or equivalent items of equipment to provide all compensation for additional charges made for the proper rough-in, circuitry and connections for the equipment furnished.

3. Contractor shall install supplemental equipment where indicated in the Construction Drawing set, in accordance with equipment manufacturer's written instructions and with recognized industry practices, to ensure that the equipment complies with requirements and serves intended purposes. Contractor shall install supplemental equipment in accordance with manufacturer’s installation instructions, level and plumb, firmly anchored, and maintain manufacturer’s recommended clearances for servicing and maintenance.

4. Contractor shall connect and install all appurtenances, accessories and devices furnished by manufacturer but not specified to be factory-mounted or packaged separately for protection during shipping. For example, remote automated valves, utility booster pumps or tank agitators shall be installed per manufacturer’s recommendations as indicated on the drawings.
5. After placement or installation, cover items with tarps or sheeting where required to protect from damage during construction.
6. Contractor shall install tanks level and plumb. Installation of weigh cells, if required, under tanks shall be completed where indicated on drawings. Installation of tanks through floors, if required, shall be completed as indicated on drawings. Contractor shall install all appurtenances not installed at manufacturer’s facility.
7. After installation is approved, all agitators shall be bumped to check rotation.

E. Start-up and Commissioning

1. Prior to final acceptance, operate systems and equipment for a minimum of 48 continuous hours after normal operating conditions are achieved, as approved by the Owner/Owner’s Representative. The Contractor shall obtain suitable training or assistance for the operation of unfamiliar systems or equipment prior to start-up or operation. The Contractor shall clean systems or equipment and install new filters, screens, etc. based on manufacturer’s recommendations prior to final acceptance by the Owner/Owner’s Representative.
2. Adjust all systems and equipment to provide operation as described on the drawings and specified herein. Properly align and adjust drive components, bearings, etc. for all equipment to eliminate excess noise and vibration as acceptable to the Owner/Owner’s Representative.
3. Commissioning is the process of verifying that the installation of equipment has been completed in a manner that allows safe and acceptable start-up, and that the equipment is functioning as intended. Commissioning encompasses the testing and documentation required to be completed before the Contractor is finished. It will serve as a tool to alleviate post-occupancy difficulty or failure of supplemental equipment, and shall record data in an effort to advance the systems from a state of substantial completion to dynamic operation and assist in the validation documentation. The Owner/Owner’s Representative and any issuance of completion certification shall complete the commissioning documentation prior to equipment installation acceptance. The documentation shall consist of Owner/Owner’s Representative provided checklists to be completed by the appropriate Contractor, and verified by the Owner or Owner’s Representative. In many instances, the equipment Manufacturer will assist with commissioning services after installation. However, it is the responsibility of the Contractor to complete all documentation.
4. Commissioning activities shall be guided by protocols and datasheets furnished by Owner/Owner’s Representative, and will consist of installation verification, operational verification and documentation. An example of the commissioning documentation has been provided with the construction specifications. The Contractors responsibilities for installation verification will consist of an installation audit that will include information pertaining to material verification, manufacturer and model number, utility connections and flow data, loop checks, cleaning and passivation. The Contractor’s responsibilities for operational verification will consist of an operational audit that will consist of information pertaining to calibration, input/output testing, operating and control demonstration, alarm verification, and start-up.

2.3 FIRESTOPPING

A. Firestopping is defined herein as the process of furnishing and installing a material, or combination of materials, in various constructions to maintain an effective barrier against the spread of flame, smoke, and gasses and to retain the integrity of time-rated construction. It shall be used in specific locations as specified hereinafter.

1. Piping penetrations through floor slab and through time-rated partitions of fire walls;
2. Opening between floor slabs and curtain walls, including inside hollow curtain walls at the floor slab;
3. Penetrations of vertical service shafts;
4. Openings and penetrations in enclosures with time-rated fire doors;
5. Other locations where specifically shown on drawings or where specified in other sections of these specifications;
6. Openings in non-time-rated construction shall be closed with a compacted fill of ¾ lb. density fiberglass and then sealed gas tight.

B. Material of firestopping shall be asbestos free and capable of maintaining an effective barrier against flame, smoke and gases in compliance with the requirements of ASTM E 814, UL NO. 1479. Fire-stopping material shall be manufactured by 3M barrier products. Products shall be capable of providing a cold smoke and water seal. When exposed to temperatures exceeding 250ºF these products shall rapidly expand up to ten times the original volume.

C. Installation of fire stopping shall be in accordance with the manufacturer’s recommendations and requirements. Surface to be in contact with firestopping shall be cleaned of dirt, grease, oil, loose materials, rust, or other substance that may affect proper fitting or the required fire resistance.

D. Firestopping materials shall provide an effective barrier regardless of the geometric configurations of the void spaces. Firestopping materials for filling voids in floors having openings of four (4) inches or more shall be installed to support the same load as the floor is designed to support, unless the area is protected by a permanent barrier preventing loading or traffic on the fire-stopped area.

E. At a minimum fire stop systems shall be designed to achieve a 2-hour F rating with an emphasis on also achieving a 2-hour T rating. In addition to fire and thermal protection, fire stop systems shall be designed to provide a barrier to the transmission of smoke and toxic fumes.

F. A firestop system as defined by these specifications shall consist of fire barrier products, in certain configuration and quantity, to meet the intent of the specifications above.

G. Firestop systems for floor and chase penetrations shall be installed on both sides of the penetration (top and bottom) (in and out). Firestop systems shall be symmetrically installed on both sides and shall meet or exceed all requirements for AT&T standard practices.

2.4 ELECTRICAL EQUIPMENT

A. General: Unless specifically specified or shown otherwise, the Contractor shall furnish required motors, variable speed drives with controls, and disconnect switches for equipment furnished under this Division. Motors, drives, and associated controls, and disconnecting equipment shall be provided where indicated and as required for operation of the equipment being furnished. Motors shall be designed for full voltage starting unless otherwise specified or noted on drawings and shall be suitable for continuous duty at 40 C. ambient. All motors shall be selected, designed and fabricated in conformance with the requirements of NEMA-MG-1 standard.

B. All motors shall be NEMA Design B induction motors with voltage and phase scheduled on drawings. Motors shall be equipped with Class F insulation, rated with a service factor of 1.15 and nominal full-load efficiency within 1.5% of the maximum values provided by the National Electrical Manufacturers Association Standard 12.6C in publication MG 1. The motor efficiency testing standards for all motors is IEEE Standard 112-1984, “Standard Test Procedure for Polyphase Induction Motors and Generators”. All motors shall have a 2% - 5% power factor improvement over typical standard efficient motors. Motors shall comply with the frame size assignments of NEMA MG 13-1984. Motor nameplate horsepower ratings shall not be exceeded when the equipment is operating within the limits of the design conditions specified. The motor loading shall not exceed the motor service factor rating on start-up conditions or at the equipment maximum load point.

C. Rating: Motor rating, service factor and nameplate data shall conform to the requirements of NEMA-MG-1 standards. Motor nameplate horsepower ratings shall not be exceeded when the equipment is operating within the limits of the design conditions specified. The motor loading shall not exceed the motor service factor rating on start-up conditions or at the equipment maximum load point.
D. Nameplate data shall conform to NEMA MG 1 requirements. For motors of one horsepower and greater, the following additional nameplate data shall be included:
1. Manufacturer’s identification number
2. Frame size number
3. Insulated system class designation
4. Service factor
5. Locked-rotor KVA code letter
6. Starting limitations (if any)
7. Hazard classification (if approved)
   a. Design and construction of each motor shall be coordinated with the driven equipment requirements.

E. Service factor - All motors of one horsepower and greater shall be furnished with a service factor of 1.15 in accordance with NEMA-MG-1.

F. Enclosures - All motors shall be self-cooled. Motors for indoor service shall have drip-proof enclosures. Motors for outdoor service shall be totally enclosed and shall have all exposed metal surfaces protected, where practical, with a corrosion resistant polyester paint or coating. Exposed unpainted and uncoated metal surfaces shall be of a corrosion resistant material. All self-ventilated open type motors and the fan hoods of totally enclosed fan cooled motors shall meet NEMA MG 1 requirements for a fully guarded machine. Totally enclosed motors shall be furnished with cast iron frames, bearing brackets and terminal housings. Fan cooled motors shall have fans fabricated of corrosion resistant metal and cast iron fan covers.

G. Bearings for fractional horsepower motors shall be designed to operate in any position or angle. One-piece sleeve bearings with wick lubrication shall be furnished where available. Ball bearings shall be furnished where sleeve bearings are not available and where axial thrust loads exceed 20 pounds.

H. Bearings for motors of one horsepower and greater shall be oil lubricated sleeve bearings. If motor frame size is such that sleeve bearings are not available, bearings shall be grease lubricated rolling element type, self-lubricated and re-greaseable.

2.5 DISCONNECT SWITCHES
A. Material - Disconnect switches shall be NEMA type HD (Heavy Duty) quick-make, quick-break disconnect switches not furnished by others with equipment and where indicated on drawings or where required by Code. Switches shall be fusible or non-fusible as called for or as required. Switches shall have NEMA I enclosure unless otherwise specified or called for otherwise on drawings. Switches shall have door interlock and shall be padlockable in "open" and "closed" position. Where indicated for use in motor circuits utilizing VSDs switch shall be furnished with interlock contacts for interface with VSD, preventing operation of VSD when load is disconnected.

B. Reference E-series drawings and Division 26 for disconnect switches provided by electrical contractor. If not shown and required it is assumed the equipment manufacturer is providing it. If not, the contractor shall be responsible for all providing including all labor for installation.

PART 3. EXECUTION

3.1 CUTTING AND PATCHING
A. The responsibility for any cutting of construction, which is required for the installation work, shall be by the Contractor. The Contractor shall coordinate with the Owner before any cutting and obtain approval from the Engineer and the Owner prior to any cutting.

B. Where openings for work within this Division are provided under other sections of the specifications, this Contractor shall be responsible for locating and providing the proper dimensions for all such openings.
C. Cutting shall be done with extreme care and in such a manner that the strength of the structure will not be endangered. Wherever possible, openings in concrete or masonry construction shall be by concrete saw or rotary core drill. Openings in any construction shall be cut the minimum size required for the installation of the work.

1. Adequate protection shall be provided to prevent damage to adjacent areas and to prevent dust from spreading to adjacent areas.
2. The use of jackhammers will not be permitted.

D. Where openings or holes are cut in existing construction and the cutting breaks existing electrical circuitry or control circuitry, or communications, conduit and wiring, then it shall be the responsibility of the Contractor to have the circuitry, conduit and rewiring re-routed and to complete the circuitry as required and as approved by the Owner. Temporary completion shall be provided where necessary before the permanent re-routing and completion work is finished. All costs for this work shall be the responsibility of the Contractor and no additions will be allowed to the Contract price.

E. Before any cutting, patching, or finishing work is started, dust and moisture protection shall first be installed as required to protect adjacent construction and equipment and to prevent dust spreading from the immediate area where work is being performed.

F. After any work is installed through any opening in walls, partitions, ceilings, or floors, the opening around the work shall be patched to match the existing construction, and the openings around pipe sleeves, between pipes and sleeves, and around ductwork shall be sealed watertight through floors and shall be sealed fireproof and smoke tight through floors, walls, partitions and ceilings.

G. Where existing work is removed from openings in existing construction and the opening is not to be reused for new work, the opening shall be filled and patched to match existing adjacent construction and to be watertight for floors and to be fireproof and smoke tight for floors and all other construction.

H. No structural member shall be cut without the approval of the Consultant, and all such cutting shall be done in a manner directed by him.

3.2 EXISTING CONDITIONS

A. Each bidder shall inspect the site as required for knowledge of existing conditions and failure to obtain such knowledge shall not relieve the successful bidder of the responsibility to meet existing conditions in performing the work under the contract.

B. Where new work cannot be installed without changes in existing plant, facility, or systems or where it is indicated on drawings to re-work an existing installation, this contract shall include alterations to existing work as required to install new work. Additions to the contract cost will not be allowed because of the Contractor’s failure to inspect existing conditions.

C. Existing conditions indicated on the drawings are taken from the best information available on previous contract drawings and from visual site inspection and are not to be construed as "As Built" conditions, but are to indicate the intent of this work. It shall be the responsibility of the Contractor to verify all existing conditions at the project site and to perform the work as required to meet the existing conditions and the intent of this work indicated.

D. Unless specified otherwise, all existing material and equipment shown or required to be removed from existing construction and not shown to be reused or turned over to the Owner shall become the property of the Contractor and shall be promptly removed from the site.

E. Any existing material or equipment which is to be reused or is to remain in place and which is damaged by this Contractor in performing the contract work, shall be repaired to the satisfaction of the Owner or shall be replaced with new equipment and material.
3.3 ELECTRICAL COORDINATION

A. All electrical products and installation used on this project shall conform unless otherwise specifically noted, to applicable standards of the National Electrical Manufacturers Association, NFPA 70, Division 26 of these specifications, and shall also be listed by Underwriter's Laboratories, Inc. and/or other agencies, as required.

B. Electrical power sources and motor connections for all equipment shall be provided as specified within Division 26 of these specifications. All control wiring, safety interlock wiring, and temperature control system wiring required shall be furnished and installed as specified within these specifications. The control wiring shall include the furnishing and installation of all conduit, boxes, fittings, devices, accessories, wire, and connections required for complete and properly functioning systems. All wiring shall be installed in conduit, and all splices and connections shall be made in approved type enclosures or boxes.

1. If motors or controls are not shown on the Electrical Drawings, it has been assumed that these motors and controls have been wired as part of a piece of package equipment, or that control wiring will be run by the Contractor.

C. Reports: The Contractor shall submit to the Engineer, after mechanical systems are completely installed and operating under normal load conditions and prior to final acceptance of the project, four (4) copies of tabulated report on each piece of mechanical equipment motor and motor starter. The tabulated reports shall show the following information:

1. Mechanical equipment identification on which motor and starter is used
2. Motor nameplate horsepower, full load amperes, and voltage
3. Motor nameplate service factor and temperature rise
4. Actual (metered) motor running amperes and voltage
5. Motor starter nameplate: HP rating and voltage
6. Motor starter thermal overload protection unit current rating, manufacturer’s name and manufacturer’s catalog number marked on thermal units.

3.4 NOISE AND VIBRATION

A. Contractor shall be responsible for the installation of all equipment in such a manner as to control the transmission of noise and vibration from any installed equipment or system, so the sound level shall not exceed NC35, in any occupied space. Contractor shall be responsible for the correction of any objectionable noise in any occupied area due to improperly installed equipment.

3.5 TEMPORARY UTILITIES, SERVICES AND CONNECTIONS

A. The Contractor shall provide temporary electric power for construction purposes in accordance with all Codes and Ordinances and as required by projects. All temporary equipment, materials and connections required for the temporary services shall be furnished and installed by the Contractor. At the completion of the project or at such time as the temporary services are no longer needed, the Contractor shall remove all temporary equipment, materials, and connections and shall restore facilities to permanent finished conditions. Contractor may obtain temporary service from the existing building.

B. Temporary wiring connections and facilities shall be installed as required, so that all spaces, fixtures, devices, equipment, and circuits that are required to stay in operation do so, and so that interruptions in the use of any space, device, fixtures or piece of equipment can be held to the absolute minimum time possible.

C. Interruptions in existing utilities, services, or in the electrical circuitry and facilities shall be scheduled and sequenced as hereinbefore specified in this section of the specifications, and sequencing shall also conform to specific requirements as specified in other sections of the specification or as indicated on the drawings. The scheduling and sequencing shall be coordinated in advance with the Owner and Architect and shall be as approved by these parties. Even though a schedule is approved, the Owner shall also be
notified immediately prior to any interruption in any electric facilities and circuits so that alternative arrangements can be made.

3.6 METHOD OF INSTALLATION
A. The Contractor shall be responsible for a scheduled sequence in performing the work so that it will not interfere with the building occupant’s operation in the existing building. Before any work is started, the Contractor shall consult with the Owner’s designated Representative and arrange a satisfactory schedule. The schedule shall be as approved by the Architect. Make temporary alterations as required to execute work so that all operations and services in the existing building are maintained with the minimum possible interruption. Temporary shutdowns shall be segregated and shall be of the shortest possible duration. All facilities shall be kept in continuous operation unless specific permission to the contrary is arranged by the Architect and or the Owner’s designated Representative.

B. The Contractor shall provide to the Owner’s designated Representative, prior to any shut down of power or systems, a typewritten detailed proposed procedure of shut down outlining each step including estimated time during the shutdown procedure, during the actual shut down, and during the start procedure. These procedures shall also indicate all equipment and systems that will be effected by the shut down. The Contractor shall not proceed with any shut down without approval of the procedure from the Owner’s designated Representative or the Owner.

C. Trades that perform work under this Division shall cooperate and confer with all other trades on the project, as to locations of their materials and equipment before erecting the work so as to avoid interference and delay in progress of construction. In instances where interference may develop, the Contractor shall relocate his work as approved by the Architect, to depart from such interferences at no additions to the contract price.

1. Where it is necessary to make adjustments in the locations or routing of conduits, wireways, or other installations (from that shown on drawings) to clear obstructions or other installed work, the Contractor shall be responsible for making these adjustments as a part of the contract work.

D. The Contractors shall coordinate with the Owner’s designated Representative as to scheduling his work in all areas and shall obtain approval from the Owner’s designated Representative prior to any disruption of services or activity. All shutdowns of services shall be maintained to a minimum.

E. Material and equipment under this Division shall be protected from dirt and damage and maintained in a clean condition during the performance of the work. This shall include adequate protection from the weather if storage is outside. All parts of material and equipment that have become rusted or damaged shall be replaced or restored to an acceptable condition as approved by the Owner’s designated Representative. This shall include factory finishes damaged during construction. Any refinishing shall be spray painted, brush applied paint will not be acceptable.

3.7 INSPECTION
A. Each bidder shall inspect the site as required for knowledge of existing conditions and failure to obtain such knowledge shall not relieve the successful bidder of the responsibility to meet existing conditions in performing the work under the contract.

B. Where new work cannot be installed without changes in existing plant, facility or systems or where it is indicated on drawings to rework an existing installation, this contract shall include alterations to existing work as required to install new work. Additions to the contract cost will not be allowed because of this Contractor’s failure to inspect existing conditions.

C. Where existing power, lighting, or control circuitry is broken by removal of existing devices, equipment, or fixtures, or by demolition work, cutting or removal of existing building construction, and where the existing circuitry is required by remaining devices or equipment to stay in service, then the circuitry shall be completed as required by job conditions.
D. Existing conditions indicated on the drawings are taken from the best information available on previous contract drawings and from visual site inspection and are not to be construed as "As-Built" conditions, but are to indicate the intent of this work. It shall be the responsibility of the Contractor to verify all existing conditions at the project site and to perform the work as required to meet the existing conditions and the intent of this work indicated.

3.8 TESTING

A. All electrical equipment furnished under this Division shall be adjusted and tested by this Contractor. Motors and other equipment furnished by others, to which electrical connections are made under this Division, shall be checked for short circuit and open circuits before energizing. Motors shall be checked for proper phasing and rotation. The thermal overload protection devices shall be checked in all motor starters, and equipment and all protection device size, motor nameplate full load amperage, and voltage rating for protection of the motor shall be listed (include equipment designation, rating of heater, motor nameplate horsepower, full load amps and voltage) and 4 copies of list shall be submitted to the Architect.

B. Mechanism of all electrical equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required. Adjustable parts of all lighting fixtures and electrical equipment shall be checked, tested and adjusted as required to produce the intended performance.

C. Completed wiring systems shall be free from short circuits and after completion, perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.

D. The Contractor shall be held responsible for the operation, service and maintenance of electrical equipment during construction and prior to acceptance by the Owner. All electrical equipment shall be maintained in the best operating condition. Operational failure caused by defective material an/or labor furnished under this Division shall be immediately corrected. Architect shall be immediately notified of any operational failures caused by defective material and/or labor covered under other Divisions or furnished by others.

3.9 START-UP

A. All labor for the installation of material and equipment furnished under this Division shall be done by experienced mechanics of the proper trade and all workmanship shall be first class and in compliance with the specific requirements of drawings and specifications.

B. All material and equipment provided under this Division shall be installed under competent supervisory service furnished by the Contractor. Where necessary, this shall include the services of special erection and operation personnel.

C. The Contractor shall furnish all hoists, scaffolds, staging, runways, tools, machinery and equipment required for the performance of work.

D. Dirt and refuse resulting from the performance of the work shall be removed from the premises daily as required (broom clean) to prevent accumulation and the Contractor shall cooperate in the maintaining of reasonably clean premises at all times.

E. Immediately prior to the final inspection, Contractor shall clean all material and equipment. Dirt, refuse and stains shall be removed from all surfaces and damaged finishes restored to original condition.

3.10 TRAINING

A. The Contractor shall furnish all services as required for adequate verbal and printed instructions to the Owner and the Owner’s operating and maintenance personnel for operation and maintenance of all equipment and systems installed under this Division. Three complete copies of service manuals in hardback binder shall be furnished at the end of the project in accordance with the General Conditions.
of the specifications. The manuals shall include printed operating and maintenance instructions for systems and equipment specified under this Division, all approved shop drawings and all manufacturer printed data.

B. When the work is complete and at a time designated by the Owner's designated Representative, the Contractor shall furnish the services of a qualified instructor to instruct the Owner's personnel in the operation and maintenance of the systems and equipment.

C. The bound copies of the operating and maintenance manuals shall be used during the verbal instructions.

3.11 PROTECTION OF EXISTING FACILITIES AND DUST CONTROL

A. Provide and maintain dust-proof and weatherproof temporary partitions from floor to ceiling for the full length required where existing walls and/or partitions are indicated to be removed and around isolated locations where it is necessary to cut or remove portions of existing walls, ceilings, floor slabs, or partitions. Erect prior to beginning work in the following manner:

1. Construct of fire retardant treated No. 2 common S.Y.P. 2"x4" studs and 1/4" thick fire retardant treated plywood. Tape all joints to be dust-proof. Fire retardant treatment shall be in accordance with the American Wood Preservers Association Standard AWPA C30B and C27B to obtain classification of 25 or less for Flame Spread and Smoke Developed rating of 50 or less. Each piece shall bear the UL label. Plywood shall be A.P.A. Grade “Sheathing Grade” or better and be laminated with waterproof glue. For interior work, fire resistive polyethylene sheet equal to Griffolyn Type 55FR (Griffolyn Houston, Texas) may be used in lieu of plywood. Flame spread rating of all materials shall be less than 25.

B. The Contractor shall provide adequate protection, wherever work is to be performed in the existing building, to prevent damage to adjacent areas, equipment, or furnishings; to prevent accidental injury to building occupants and the public; to prevent the spreading of dust, dirt, debris, and moisture from the area where work is being performed; and to prevent dust, dirt, debris, and moisture from getting on or in the building occupant's furnishings or equipment.

C. Every precaution shall be taken during handling, transporting, erection, and performing any work to prevent and eliminate dust, debris, and moisture from entering or being carried into spaces outside the work area and onto or into the building occupant’s equipment or furnishings that may remain in the area of work. Cutting, patching, finishing, painting, or any other construction work, which will cause dirt or dust to be created, shall be separated from occupied spaces by temporary dustproof partitions or curtains sealed at top, bottom and all around. Curtains or dust catching covers may be fire-resistant polyfilm sheeting or other approved effective materials. Dust mats shall be provided as necessary and shall be kept clean to prevent tracking dust, dirt or debris from the work areas.

END OF SECTION 230500
SECTION 230501 – HVAC WORKING IN EXISTING FACILITY

PART 1. GENERAL

1.1 SEQUENCE OF WORK

A. The project schedule provided with the Contract Documents is the suggested sequence of work providing the Contractor with the intentions and desires of the Owner’s relative to service, testing of the new system and equipment, and cutover preferences. The sequencing is suggested only, and in no way alleviates the Contractor from preparing a schedule of the necessary work for review by the Owner and Engineer as specified in other sections.

B. Since work involved in this project will involve shutdowns of various items of equipment, the Contractor shall have on hand, at the site, all necessary material and manpower required to re-energize and/or restore operation to all equipment in an emergency situation.

1.2 INTERIM CONTROL

A. Contractor shall assist the Owner, Commissioning Agent and Engineer in providing Mechanical System drawings showing configurations at the end of each sequence. Drawings shall provide the Owner with necessary information to operate the entire mechanical system including temporary equipment, and controls needed during the shutdown procedures.

B. Contractor/Owner/Consultant/Commissioning Agent shall develop step-by-step operation procedures to detail system operation for each interim system configuration.

C. Contractor shall post interim drawings and operation procedures at locations directed by the Owner.

1.3 VISIT TO SITE OF WORK

A. Visit site and survey existing conditions affecting work prior to bid. Include necessary materials and labor to accomplish the work, including relocation of existing services and utilities on building site in bid. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interference shall be reported immediately to Owner/Consultant.

1.4 CONTRACTOR’S USE OF PREMISES

A. Confine operations at site to areas and limits permitted by law, ordinances, permits; Contract Documents and GENERAL CONDITIONS.

B. Protection and safekeeping of products stored on premises is responsibility of contractor supplying product.

C. Deliveries and unloading shall be scheduled to prevent traffic congestion blocking of access or interference with Work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.

D. Contractor shall pay for, or satisfactorily repair, all damages incident to their Work, to sidewalks, streets, other public or private property, or to any public utilities occurring during period of work under this Contract.

PART 2. EXISTING FACILITY REQUIREMENTS

2.1 DEMOLITION OF EXISTING SYSTEMS

A. Demolish existing mechanical work, including auxiliary systems, in areas of existing building shown reworked. Coordinate removal of mechanical systems with Owner and Engineer.

B. In reworked areas, remove all mechanical equipment; i.e.: piping, equipment, drains, auxiliary system devices, etc.; unless otherwise noted.

C. Abandon piping underground and in existing masonry walls:

1. Isolate and cap using approved materials. Cap at both ends of abandon pipe.
2. Fill abandoned underground steam and condensate lines with a concrete slurry as noted on drawings.

2.2 CONTINUITY OF SERVICE/METHOD OF PROCEDURE

A. Assist Owner and Consultant in preparation of a Method of Procedure (MOP) to accomplish all work requiring interruption of mechanical service to any equipment prior to work. The Consultant will fill out the standard parts of the MOP. The Contractor is responsible to provide a detailed sequence of work for the step-by-step performance of the MOP to the Owner, and walk through the steps with the Owner, pointing out the work to be done. The MOP requires a detailed list of equipment and systems that will be shutdown during the work. The contractor will, upon request, be given the MOP in electronic format from the Engineer. The completed MOP shall be given back to the Engineer in the same electronic format.

2.3 HAZARDOUS MATERIALS

A. Submit Material Safety Data Sheets for all materials furnished in this project defined as hazardous by NFPA. All requirements of the Material Safety Data Sheets shall be implemented and followed judiciously when hazardous materials are installed or otherwise used.

B. All hazardous materials shall be stored and used (mixed, applied, etc.) in strict accordance with the OSHA Standards, Safety Data Sheets and the Owner’s Safety standards.

C. Refrigerants, nitrogen, welding gas, paints, varnish, volatile oils, etc., shall be stored in a room having good ventilation and containing no other material, or in metal lockers or barrels well away from structures or other combustible materials.

2.4 WELDING AND CUTTING

A. Special precautions shall be taken to reduce fire hazards where electric or gas welding or cutting work or soldering is done and suitable fire extinguishing equipment shall be maintained near such operations. Before proceeding with any electric or gas welding or cutting or soldering work in or adjacent to the existing building the Contractor shall obtain a permit from either the Engineer or Owner. The permit shall be issued by its authorized supervisor or representative certifying compliance with conditions set out in the permit pertaining to welding and cutting operations.

PART 3. EXECUTION

Not Used.

END OF SECTION 230501
SECTION 230529 - HVAC SUPPORTS & ANCHORS

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Piping Hangers and Supports
B. Duct Hangers and Supports

PART 2. EQUIPMENT

2.1 PIPING HANGERS AND SUPPORTS

A. Provide factory-fabricated horizontal piping hangers, clamps, attachments and supports in compliance with ANSI SP-69 and ANSI SP-89. Select hangers and supports sized to exactly fit pipe size for bare piping, and to exactly fit around pipe insulation with saddle and shield for insulated piping. Hangers in contact with copper pipe shall be copper plated.

B. Unless specified otherwise, pipes shall be hung with malleable iron, split ring hangers or clevis hangers not less than 1/8” thick. Strap type hangers shall not be acceptable. Roller type hangers shall be used where required or shown to allow for movement of pipes by expansion. Hangers shall have rods and turnbuckles of required length. Suspension shall be from suitable steel supports fastened to overhead construction or steel wall brackets. Hangers and supports shall be installed so that pipes are run parallel and evenly spaced.

C. Anchors in concrete construction shall be threaded compound type or Phillips self-drilling type of sufficient size to adequately support the load.

D. Manufacturer:
   1. Hangers and supports:
      b. Kindorf Mfg.
      c. Unistrut Mfg., Inc.
      d. Fee Mfg.
   2. Saddles and shields:
      a. Pipe Shields, Inc.

2.2 DUCT HANGERS AND SUPPORTS

A. Material - Duct hangers shall be galvanized steel band iron or 1¼” x 3/16” angle and 3/8” rods. Wall supports for ductwork shall be galvanized steel band iron or fabricated angle bracket. Support vertical ductwork at floor with rolled 1¼” x 3/16” structural steel angle.

B. Duct Supports: Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts straight, plumb, free of sags and vibration, and to prevent buckling. Support ductwork from building structure where not otherwise indicated, anchor with bolts, concrete inserts, welded studs, C-clamps, or special beam clamps with support as indicated in the SMACNA Standards. Anchor methods other than listed shall receive prior approval from Owner before using. Support vertical ducts, at every floor, 12 foot maximum spacing, by attachment to adjacent vertical structural surfaces or by direct bearing at floor penetrations and similar locations.
PART 3. EXECUTION

3.1 METHOD OF INSTALLATION

A. Comply with MSS SP-69 and SP-89 for installation of hangers, supports and anchors. Install hangers, supports, clamps, and attachments directly from building structure complete with inserts, bolts, rods, nuts and washers, and washers, and accessories. Do not use wire or perforated metal to support piping; pipe support from other piping shall not be permitted. Install hangers with minimum ½” clear space between finished covering and adjacent work. Place hanger within 1 foot of each horizontal elbow. Use hangers vertically adjustable 1½” minimum after piping is erected.

B. Insulated pipe, hangers and supports shall be furnished with ribbed galvanized steel shields of not less than 18 gauge; two-piece pre-molded, high compressive strength, insulation inserts (360° around pipe); and vapor barrier jacket covering the insulation inserts. Inserts shall be constructed of high density, 100 psi, waterproofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.

C. Maximum spacing of hangers and supports shall be in accordance with the following schedule for size of pipe:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Rod Size</th>
<th>Ferrous Pipe</th>
<th>Copper Pipe</th>
<th>Plastic Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>½” &amp; ¾”</td>
<td>1/4”</td>
<td>8'-0”</td>
<td>6'-0”</td>
<td>4'-0”</td>
</tr>
<tr>
<td>1” &amp; 1¾”</td>
<td>3/8”</td>
<td>9'-0”</td>
<td>7'-0”</td>
<td>4'-6”</td>
</tr>
<tr>
<td>1½”</td>
<td>3/8”</td>
<td>9'-0”</td>
<td>8'-0”</td>
<td>5'-0”</td>
</tr>
<tr>
<td>2” &amp; 2½”</td>
<td>3/8”</td>
<td>10'-0”</td>
<td>9'-0”</td>
<td>5'-0”</td>
</tr>
<tr>
<td>3” &amp; 4”</td>
<td>5/8”</td>
<td>10'-0”</td>
<td>10'-0”</td>
<td>6'-0”</td>
</tr>
<tr>
<td>6” to 12”</td>
<td>7/8”</td>
<td>14'-0”</td>
<td>7'-0”</td>
<td></td>
</tr>
<tr>
<td>14” to 18”</td>
<td>1”</td>
<td>20'-0”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D. Hangers for cast iron pipe shall be installed on maximum 5'-0” centers.

E. Supports on masonry walls shall have bolts through wall fastened to suitable steel plate on back of wall. Where required to allow for movement of pipe by expansion due to short hanger rods, pipes shall rest on rollers and covering protection saddles. All piping shall be supported and secured as required to prevent vibration and the transmission of noise and lateral movement.

F. The Contractor shall furnish and install all necessary material, hangers and support including all structural steel members and shapes to substantially support and/or suspend all piping and equipment, in an approved manner. Perforated strap hangers will not be acceptable.

1. Drive screws, pins, studs, etc., which are secured in place by means of explosive force will not be permitted.

2. Except as specifically otherwise approved, no item of equipment shall support any pipe or duct nor shall any item of equipment be supported on any pipe or duct.

G. Hangers shall be provided at every item of equipment and at every change in direction or branch connection to every pipe.

H. All pipes through roof shall be installed with sleeves and openings, and with roof flashing/counterflash assembly or pipe curb assembly as herein specified. The complete installation shall be coordinated with the roofing installer and shall be watertight and weather tight.

I. Sleeves shall be steel pipe and shall be installed for single pipe installation. Openings shall be boxed out for multiple installations. Sleeves for acid waste vent stacks shall be installed as specified under the heading: Sleeves and Openings.
J. Single, un-insulated pipes through roof shall be installed with flashing/counterflashing assembly with four pound seamless lead flashing assembly with 8" high boot and not less than 8" skirt. A conical shaped steel reinforcing boot underneath lead flashing assembly shall also be installed. Cast iron counterflashing fitting with rust-resistant prime coat, of the caulking type to fit over all types of piping, vandal-proof set-screws for anchoring in place, and top annular space for sealant fill shall also be installed for single, un-insulated pipes. Assemblies shall be furnished in sizes to properly fit size of pipe with which they are installed. Flashing assembly shall be designed to fit properly on roofs from level up to 20° pitch. Top of flashing cone shall be sealed before installing counterflash fitting. Annular space in top of counterflash fitting shall be completely filled with epoxy sealing compound.

K. Grouped multiple pipes through roof and insulated pipes through roof shall be installed with factory prefabricated metal curb assembly of unitized construction of not less than 18 ga. galvanized steel with base plate for anchoring to roof deck or roof slab. The cant base for roof insulation thickness shall match the thickness of insulation where it is to be installed. A wood nailer strip shall be installed on top of the curb, and shall have 1½” thickness of 3 lb. density fiberglass insulation on inside, and not less than 11” high from base to top of wood nailing. The curb assembly shall also have an acrylic clad ABS plastic flashing cover with number and size of formed openings as required for the number and size pipes through roof, along with a graduated step neoprene boot for each pipe. A neoprene boot shall be secured around pipe and around formed opening in flashing cover with stainless steel clamps for waterproof connections. Insulation on insulated pipes shall be continuous through the curb, flashing cover, and the neoprene boot. After roofing is flashed up over the curb and secured in place, the ABS plastic flashing cover shall be installed over curb and flash roofing and anchored in place for a watertight and weather tight installation.

L. Furnish and set all boxouts for openings and all sleeves for work to be installed under this division. Sleeves shall be installed for all pipes passing through floors, walls, and partitions. All sleeves shall be set tight in construction, without space between the sleeve and construction. Sleeves through walls and partitions shall be flush at each end and sleeves through floor shall extend 2” above finished floor unless indicated otherwise.

M. Sleeves through concrete slabs, concrete walls, and bearing masonry walls shall be steel pipe of not less than Schedule 30. Sleeves through non-bearing wall and partitions may be Schedule 10 pipe or 22 ga. sheet steel with formed bead on each end.

N. The annular space around bare pipes and pipe insulation on insulated pipes through sleeves shall be packed tightly with mineral wool to prevent transmission of air and sound. Each end of sleeve at floors and through fire-rated walls shall also be sealed with 1” thickness of waterproof and fireproof caulk equivalent to 3M #CP2S fireproofing caulk.

O. Sleeves for round and rectangular ducts shall be galvanized steel. Sleeves through fire and smoke walls shall comply with NFPA 90A. Size sleeves to allow for expansion movement and to provide for continuous insulation.

P. Duct Hangers and Supports Installation
1. Provide and install duct hangers and supports as indicated on the following schedule:
2. Low velocity ducts hanger minimum sizes:
   a. Up to 30” wide: 1¼” x 3/16” angle at 10 feet spacing
   b. 31” to 48” wide: 1½” x 3/16” angle at 10 feet spacing
   c. Over 48” wide: 1½” x 3/16” angle at 8 feet spacing
3. Horizontal duct on wall supports minimum sizes:
   a. Up to 18” wide: 1½” x 16 gauge or 1” x 1” x 1/8” at 8 feet spacing
   b. 19” to 40” wide: 1½” x 1½” x 1/8” at 4 feet spacing

Q. Assemble and install ductwork in accordance with SMACNA standards, in a manner which will achieve air-tight and noiseless systems, capable of performing each indicated service. Align ductwork accurately at connections. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will
hold ducts straight, plumb and free of sags and vibration. Ducts shall be supported with steel rods of not less than 3/8” diameter or not less than 1” wide, 16 gauge galvanized steel straps.

R. Support ductwork from building structure where not otherwise indicated, anchor with bolts, concrete inserts, steel expansion anchors, welded studs, C-clamps, or special beam clamps. Supporting ductwork from piping, electrical equipment or cable trays will not be permitted.

S. Arrange hangers, supports and duct resets to permit free, unrestrained and noiseless expansion and contraction of duct. Vertical members may be fastened to duct sides with sheet metal screws. Seals all screw attachments to ductwork with mastic and seal gas tight.

T. Each Contractor shall provide all structural steel and materials necessary to properly support and anchor equipment and lines provided under this contract.

U. All equipment and materials shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and suitable for the service required.

V. Concrete bases shall be provided where shown on the drawings. Equipment which is to be grouted in place shall be grouted with Embeco or approved non-shrink grout.

END OF SECTION 230529
SECTION 230553 – HVAC MECHANICAL IDENTIFICATION

PART 1. GENERAL

1.1 DESCRIPTION OF WORK
A. Mechanical Identification for:
   1. Ductwork systems
   2. Piping systems
   3. Valves
   4. Mechanical equipment
   5. Warning signs
   6. Control devices, pneumatic pipe and wiring
   7. Painting

1.2 SUBMITTALS
A. Submit shop drawings in accordance with General Requirements, Division 1, Section 013300.
B. Submit copies valve schedule for each piping system, typewritten and reproduced on bond paper. Tabulate valve number, piping system, system abbreviation, location of valve and variations for identification. Mark valves which are intended for emergency shut-off and similar special uses, by special "flag", in margin of schedule. Include valve schedules within Maintenance Manuals and Division 1.

PART 2. EQUIPMENT

2.1 MECHANICAL IDENTIFICATION MATERIALS
A. Stencils: Fiberboard: ANSI A13.1 letter sizes for piping and similar applications; minimum 1-1/4" high letters for ductwork and minimum 3/4" high letters for access door signs and similar operational instructions. Stencil paint: Exterior type black.
B. Valve tags: 19 gauge polished brass, 1-1/4" diameter, stamp engraved black enamel fitted. Valve tag fastener shall be solid brass chain.
   1. At Contractors option, valve tags may be 3/32" thick engraved plastic laminated valve tags, within piping system abbreviation in ¼" high letters and sequenced valve numbers ½" high letters, and with 5/32" hole for fastener. Valve tag shall be white with black lettering.
C. Valve schedule frames: For each page of valve schedule, provide glazed display frame with screws for removable mounting on masonry walls. Frame shall be extruded aluminum with SSB-grade sheet glass.
D. Engraved plastic-laminate signs: Engraving stock melamine plastic laminate; sizes and thicknesses indicated; engraved with engraver's standard letter style of sizes and wording indicated; punched for self-tapping stainless steel fasteners. Laminated signs thickness shall be 1/16" for units up to 20 sq.in. or 8" length and 1/8" for larger units. [Laminated tags and signs shall be white with black lettering except for warning signs shall be red with white lettering.

PART 3. EXECUTION

3.1 DUCTWORK IDENTIFICATION
A. Identify air supply, return, exhaust, intake and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow. Locate identification in each space where ductwork is exposed, or concealed only by removable ceiling system and near points where ductwork originates or continues into concealed enclosures, (shaft, underground or similar concealment) and at 50 foot spacing along exposed runs.
B. Access doors shall have stenciled type signs on each access door in ductwork and housings. Indicate purpose of access (to what equipment); and other maintenance and operating instructions, and appropriate safety and procedural information.

3.2 PIPING IDENTIFICATION

A. Identify piping with stenciled signs and arrows, showing piping service. Locate wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

B. Identify piping near each valve and control device and near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is questionable and near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

C. Identify piping at access doors, manholes and similar access points which permit view of concealed piping and near major equipment items and other points of origination and termination.

D. Piping shall be identified at specified hereinbefore and spaced intermediately at maximum spacing of 50 feet along each piping run. However, reduce spacing to 25 feet in congested areas of piping and equipment.

3.3 VALVE IDENTIFICATION INSTALLATION

A. Valve tag location: Provide valve tag on all valves, cocks, and control devices in each piping system. List each tagged valve in valve schedule for each piping system. Mount valve schedule frames and schedules in machine room where directed by Owner’s Representative.

3.4 MECHANICAL EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate signs except where lettering larger than 1” is required for proper identification. Locate signs in or near each piece of mechanical equipment and each operation device.

1. Provide plastic laminated signs at main control and operating [valves, fans, pumps, meters, gauges, thermometers, thermostats, VAV boxes, fan terminal units, duct mounted coils, control devices, sensors, fans and primary balancing dampers].

2. Laminated tags, at a minimum, shall be provided for each piece of equipment scheduled on drawings.

B. All temperature sensors, differential pressure switches, and control devices integrated with the building control systems shall be permanently marked to indicate normal operating points or range for both summer and winter operation. Coordinate with Engineer and Owner prior to marking. In addition, all room sensors shall have laminated tags mounted adjacent to the room sensor on wall or within the cover of the sensor itself. The laminated tag shall indicate the device which the sensor serves; (RC-1, VAV-1 etc.).

3.5 WARNING AND DANGER SIGNS

A. Where identifications signs are required to indicate a warning or danger, signs shall be plastic laminated with red background and white lettering. At a minimum warning signs shall be provided as follows:

1. All air handling unit access doors to fans and access doors downstream of fan discharge and elsewhere as required, to indicate an unsafe condition.

2. All motor driven equipment that automatically starts shall include a warning sign indicating such. Coordinate wording of danger sign with facility manager.

3.6 PAINTING

A. All new piping shall be painted including all steel supports, pipe hangers, valve handles, valve yokes and iron surfaces of every nature. Thoroughly clean all pipe covering and equipment before painting. All paint shall be applied with a brush.
B. All canvas and PVC jackets on piping shall be brush painted with prime coat of Foster's No. 81-42W lagging primer and one finish coat of Sophir-Morris, Sherwin Williams, or Cooks high gloss enamel. Color shall meet Owner's color scheme. Coordinate with Owner in the field.

C. All exposed steel, including structural members for mechanical equipment, piping, structural steel bases, and all other non-ferrous metals, shall be painted with a high solids epoxy coating manufactured by Ameron - Amerlock-400 or approved equal. Apply epoxy coating in accordance with manufacturers written instructions.

D. All painting that will be exposed to weather shall be painted with Aliphatic Polyurethane manufactured by Ameron - Amersheild or approved equal. All painting shall be applied in accordance with manufacturers written instructions.

END OF SECTION 230553
SECTION 238220 – TERMINAL UNITS

PART 1. GENERAL

1.1 DESCRIPTION OF WORK
   A. Electric Radiation Heaters

1.2 RELATED DOCUMENTS
   A. Air Movement and Control Association, Inc., AMCA:
      2. Guide 16: Steam and Hot Water Unit Heaters Installation/Maintenance.
   B. Air Conditioning and Refrigeration Institute, ARI:
      3. Standard 440: Room Fan-Coil Air Conditioners.
      4. Standard 445: Room Air Induction Units.
   C. American Gas Association, AGA.
      1. American National Standards Institute, ANSI Z83.6 and Z83.6a: Vented Infrared Radiant Heater.
      3. Underwriters Laboratories, UL 883: Safety Standards for Fan-Coil Units and Room Fan Heater Units.

1.3 QUALITY ASSURANCE
   A. Provide electrical components for terminal units listed and labeled by Underwriters Laboratory.
   B. Provide heating terminal units which are Institute of Boiler and Radiator Manufacturers performance rated with affixed I=B=R Insignia.

1.4 SUBMITTALS:
   A. Submit in accordance with Division 1, Section 01300.
   B. Product Data:
      1. Submit manufacturer’s specifications showing dimensions, capacities, ratings, performance characteristics, gauges and finishes of materials, and installation instructions.
      2. Submit schedules of radiation heating elements and enclosures indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat to actual heat output provided.
   C. Shop Drawings
      1. Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.
      2. Show mechanical and electrical requirements.
PART 2.  PRODUCTS

2.1  GENERAL
   A.  Base radiation and convector capacities on 65° F. entering air temperature, 180° F. average water
       temperature.
   B.  Base unit heater and fan-coil capacities on 65° F. entering air temperature, 180° F. entering water
       temperature.
   C.  For each convection type heating unit not thermostatically controlled, provide knob-operated internal
       damper at enclosure air outlet grille.
   D.  Where group of rooms is zoned on 1 thermostat, provide dampers on heating units in each room.
   E.  For inaccessible valves, provide factory-made permanently-hinged access doors, 6 inch x 7 inch
       minimum size; integral with cabinet.
   F.  Paint portion of unit visible through discharge opening with flat black enamel.

2.2  ELECTRIC RADIATING HEATERS
   A.  Furnish and install electric radiation heaters where specified.  The heater shall be constructed of 18
       gauge steel reflector.  The dimensions vary with heater wattage.  Finish shall be a white durable powder
       coated paint on bezel.
   B.  The heaters shall have a ceramic heating element installed in the frame.  The heating element shall be
       open exposed ceramic type with multiple voltage/wattage as specified.  Heaters shall have standard
       manual reset thermal limit safety switch.  Provide thermostat, disconnect, and relays.
   C.  Heater shall be designed for recessed or surface mounting installation.  They may be wall mounted or
       ceiling mounted.  Refer to on-drawing schedule.  Minimum clearance from heater to adjacent wall or
       floor is 3 inches.  The heaters must be installed with wall rough-in box (surface or recessed).  Furnish
       with stand-off brackets on surface mounting applications.
   D.  Refer to plans for capacity of heater and wattage of heater.
   E.  Manufacturers
       1.  Radiant Electric Heat
       2.  Re-verber-ray
       3.  Chromolox
       4.  QMark / Marley

PART 3.  EXECUTION

3.1  GENERAL INSTALLATION
   A.  Install units as indicated, and in accordance with manufacturer's installation instructions.
   B.  Provide each unit with shut-off valve on supply and lockshield balancing valve on return piping.
       1.  Accessibility:
       2.  Provide each unit with easily accessible manual air vent at high points.
       3.  When not easily accessible, extend vent to exterior surface of cabinet for easy servicing.
       4.  For fan-coil units and unit heaters, provide float-operated automatic air vents with stop valve.
       5.  Locate each unit accurately in position indicated with sufficient clearance for normal service and
           maintenance, including clearance for enclosure removal.
   C.  Support hanging units from structure as detailed on Drawings.
D. Level or pitch units and elements to indicated tolerance; shim.

3.2 INSPECTION
A. Comb out damaged fins where bent or crushed, before covering elements with enclosures.
B. Clean dust and debris from each unit as it is installed.
C. Touch-up finish on each cabinet and component after final adjustments are made.
D. Install new filter units for terminals requiring same.
E. Replace heating elements which have excessively damaged fins, and replace enclosures and accessories which are damaged beyond restoration to acceptable condition.

3.3 FIELD QUALITY CONTROL:
A. Repair or replace terminal equipment to eliminate leaks, following purging and tightness testing of piping, and retest by specified method to demonstrate proper performance.
B. Flush system before opening stop valve to hydrostatically test fan-coil units.

END SECTION 238220
SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Sleeves for raceways and cables.
   2. Sleeve seals.
   4. Common electrical installation requirements.

1.2 SPECIFICATION FORM AND DEFINITIONS
A. Design Engineer, hereinafter abbreviated D/E shall mean the Engineering firm, Olsson Associates, 1251 NW Briarcliff Dr, Kansas City, MO, Telephone (816) 361-1177.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES
A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
B. Cast-Iron Pipe Sleeves: Cast or fabricated “wall pipe,” equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
C. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS
A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   3. Pressure Plates: Carbon steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.
2.3 GROUT
A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION
A. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items, unless otherwise noted.
B. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
D. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS
A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
E. Cut sleeves to length for mounting flush with both surfaces of walls.
F. Extend sleeves installed in floors 2 inches above finished floor level.
G. Size pipe sleeves to provide 0.25-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

3.3 FIRESTOPPING
A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500
SECTION 260502- TEMPORARY ELECTRICAL FACILITIES

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish temporary electrical facilities to provide lighting and power for construction. Temporary power must be installed in accordance with the National Electrical Code, National Electrical Safety Code, local utility, local codes and authority having jurisdiction.

B. Coordinate temporary electrical facilities with other trades.

C. Work or cost not included in the Section:
   1. Electrical energy cost during construction period.
   2. Circuits for equipment requiring either heavy current or special voltages (Negotiate directly between this Division and other Divisions requesting special services).
   3. Circuits for exterior lighting
   4. Relocation of temporary wiring after installation
   5. Wiring not specified below.

1.2 TEMPORARY UTILITIES, SERVICES AND CONNECTIONS

A. The Contractor shall provide temporary electric power for construction purposes in accordance with all Codes and Ordinances and as required by projects. All temporary equipment, materials and connections required for the temporary services shall be furnished and installed by the Contractor. At the completion of the project or at such time as the temporary services are no longer needed, the Contractor shall remove all temporary equipment, materials, and connections and shall restore facilities to permanent finished conditions. Contractor may obtain temporary service from the existing building.

B. Temporary wiring connections and facilities shall be installed as required, so that all spaces, fixtures, devices, equipment, and circuits that are required to stay in operation do so, and so that interruptions in the use of any space, device, fixtures or piece of equipment can be held to the absolute minimum time possible.

C. Interruptions in existing utilities, services, or in the electrical circuitry and facilities shall be scheduled and sequenced, and sequencing shall conform to specific requirements as specified in other sections of the specification or as indicated on the drawings. The scheduling and sequencing shall be coordinated in advance with the Owner and Engineer and shall be as approved by these parties. Even though a schedule is approved, the Owner shall also be notified immediately prior to any interruption in any electric facilities and circuits so that alternative arrangements can be made.

PART 2. PRODUCTS

2.1 MATERIALS

A. General: Provide new or used materials and equipment suitable for intended use. Ensure safe, adequate performance of facilities in accordance with governing regulations. Used equipment shall be in good, safe working order.
PART 3. EXECUTION

3.1 INSTALLATION AND OPERATION
A. Except for self-contained facilities, connect and terminate temporary electrical facilities at locations required for proper distribution.
B. Do not subject electrical facilities on either temporary work or temporary use of permanent work to excess demand or overload.

3.2 SERVICE CONNECTION
A. Obtain temporary service from Power Company. Install service in conformance with NEC 230.
B. Include charges of Utility Company for temporary service connection. Pay all "Connect and disconnect charges of Utility Company".

3.3 GROUNDING
A. Power service and distribution system shall be properly grounded in accordance with NEC requirements.
B. Ground the system neutral in accordance with NEC 250.
C. Provide feeders and branch circuits with ground wire sized per NEC 250-95. The raceway system is not acceptable as a grounding means.

3.4 POWER SYSTEM AND DISTRIBUTION
A. Provide required distribution and capacity of system. Over-current protection, fusible and/or circuit breakers sized per NEC.
B. For 120/240 volts, single phase system; use 3-wire 120/240-volt feeders and branch circuits.
C. Step-down transformers inside building shall be dry-type construction; protect from weather and construction damage.
D. Use No. 12 wire for branch circuits less than 100 feet to last outlet, and No. 10 wire for circuits beyond 100 feet. Install branch circuits using NEC approved wiring methods.
E. Balance loads connected to 3 phase services within reasonable limits.

3.5 PLUG-IN RECEPTACLES
A. Use 20A, duplex, NEMA grounded type or as required for special equipment.
B. Branch circuits feeding receptacles shall be 20A or as required for special equipment.
C. Provide receptacles to be reached by 50-foot extension cord.
D. All receptacle circuits shall be protected by dynamic type ground-fault circuit interrupters, which automatically disconnect circuit when leakage current of 4-6mA is detected.
E. Receptacles shall not be placed on the same circuit with temporary lighting.

3.6 TEMPORARY LUMINARIES
A. Provide luminaries approved by NEC for temporary construction wiring.
B. Lamps shall be rough service incandescent 150 watt to 300 watt equipped with guards to protect from contact and damage (sizes as directed).
C. For estimating purposes, figure total number of light sockets as follows:

1. One for every 300 sq. ft. of interior rooms
2. One for every 750 sq. ft. of exterior rooms with windows
3. Exterior rooms, which contain windows with room depth less than 10 feet from exterior wall, require no socket. Exterior rooms more than 10 feet deep calculated by excluding exterior 10-foot bay.
4. Fluorescent luminaries may be used at contractor’s option.

3.7 LAMPS AND REPLACEMENTS

A. Provide lamps.
B. Replace burned out lamps to maintain required lighting levels throughout the duration of the project.

3.8 INSTALLATION OF CIRCUITS

A. Install required lighting and receptacle circuits along a route least objectionable to construction work as determined by Contractor. Protect circuits where exposed to damage.

3.9 PERMANENT WIRING SYSTEM

A. Do not use permanent wiring for construction without specific acceptance of Consultant. Before using permanent wiring for temporary service, submit a list of uses to Consultant. Consultant may refuse use of permanent equipment for temporary service. Use of permanent equipment prior to Substantial Completion shall not affect warranty period.

3.10 REMOVAL AND RESTORATION

A. Temporary wiring shall be removed immediately upon completion of construction or purpose for which the wiring was installed. Repair or replace work damaged by temporary electrical facilities. Clean and restore permanent electrical system used to provide temporary services to condition of new and unused work.

1. Electrical work installed as temporary facilities, upon removal, remains property of Installer.
2. Replace lamps of permanent light fixtures used for temporary lighting, which have burned out or are noticeable dim. All permanently installed fixtures in the construction area lamps shall be removed and cleaned.
3. Where temporary use of lamps exceeds 50 percent of lamp life, replace lamps.

B. At Substantial Completion, clean permanent electrical work used as temporary facilities. Remove debris accumulated in electrical spaces.

END OF SECTION 260502
SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.
   3. Sleeves and sleeve seals for cables.

1.2 GENERAL

A. Wires (Single Conductor) and Cables (Multi-conductor Assemblies) used for the following applications:
   1. Power: 120/240V Systems
   2. Lighting: 120/240V Systems
   3. Control: 120V
      a. Low Voltage Control & Instrumentation
      b. Wiring Connectors and Connections
      c. Grounding and DC Cabling

1.3 SUBMITTALS

A. Submit in accordance with Division 1, Section 01300.
B. Product Data: Submit manufacturer’s technical product data, including specifications and installation instructions.

1.4 QUALITY ASSURANCE

A. Codes and Standards:
   1. NFPA 70: National Electrical Code
   2. UL 83: Thermoplastic Insulated Wire
   3. UL 1063: Machine Tool Wire
   4. UL 44: Rubber Insulated
   5. UL 854: Service Entrance Cables

1.5 Acceptable Manufacturers:

A. POWER, LIGHTING and 120 VOLT CONTROL
   1. American Insulated Wire
   2. Essex-Paranite Cable
   3. Rome Cable

B. LOW VOLTAGE CONTROL & INSTRUMENTATION
   1. Alpha
   2. Belden
   3. Dekoron
PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.
B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.
C. Multi-conductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 POWER, LIGHTING, & 120V CONTROL

A. NEC Type THHN/THWN (90°C Dry/75°C Wet)
B. Single conductor, stranded (all sizes), soft annealed copper conductors with 600 volt thermoplastic insulation and nylon jacket.
C. Wire smaller than No.12 gauge shall not be used unless specifically called for on drawings or in specifications. All emergency lighting branch circuit wire from emergency panels shall be No. 10 AWG.
D. Wire insulation shall be color coded as follows:
   120/240V, 1 phase, 3 wire

<table>
<thead>
<tr>
<th>Phase</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Black</td>
</tr>
<tr>
<td>B</td>
<td>Red</td>
</tr>
<tr>
<td>Neutral</td>
<td>White</td>
</tr>
<tr>
<td>Ground</td>
<td>Green</td>
</tr>
</tbody>
</table>

E. Black insulation is acceptable for #8 wire or larger. Conductor ends shall be wrapped with colored tape as indicated above.

2.3 LOW VOLTAGE CONTROL AND INSTRUMENTATION

A. Application: Conductor operating voltage shall not exceed 50-volts.

1. Shielded single twisted pair, 600V, 90-degree C:
   a. Conductors-16 AWG, stranded copper
   b. Conductor insulation of PVC with a nylon jacket
   c. Foil shield with tinned copper drain wire
   d. Black PVC outer jacket
   e. Wire insulation color coded black and white
   f. Dekoron #IC 52-67000 or equal

2. Shielded three-conductor, 600V, 90-degree C:
   a. Conductors-16 AWG, stranded copper
   b. Conductor insulation of PVC with a nylon jacket
   c. Foil shield with tinned copper drain wire
   d. Black PVC outer jacket
   e. Wire insulation color coded black, white, and red
   f. Dekoron #IC 62-67000 or equal

3. Overall shielded, multiple pairs, 600V, 90-degree C:
   a. Conductors-18 AWG, stranded copper
   b. Conductor insulation of PVC with a nylon jacket
   c. Foil shield with tinned copper drain wire
   d. Black PVC outer jacket
   e. Wire insulation color coded black, white, and numbered
   f. Dekoron or equal #IC 70-80400: 4 pair
4. Overall shielded, multiple conductor; 600V, 90-degree C:
   a. Conductors-14 AWG, stranded copper
   b. Conductor insulation of PVC with a nylon jacket
   c. Foil shield with tinned copper drain wire
   d. Black PVC outer jacket
   e. Wire insulation color coded black with printed number and color.
   f. Dekoron or equal
   g. #IC 99-40500-001: 5 conductor
   h. #IC 99-40900-002: 9 conductor
   i. #IC 99-41200-002: 12 conductor

B. Cables shall pass the U.L. 1581 Vertical Tray Flame Test, and be listed as Tray Cable under U.L. 1277 and in accordance with NEC Articles 318, 340, and 501.

C. Ground conductors connected to structure shall be connected with non-metallic approved fasteners.

2.4 CONNECTORS AND SPLICES

A. Provide UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, type and class for application and for service indicated. Select connectors to comply with Project’s installation requirements and as specified in Part 3 "Applications" of this Article.

B. For Conductors #10 AWG and Smaller: Wire and cable connectors shall be solderless, twist on, 600 volts, 105°C, shall comply with UL 486A/C standards. Connectors coded for easy selection compatible with wiring to be spliced. Install connectors as recommended by manufacturer. Use proper crimping tool where crimp sleeves are used.

2.5 Acceptable Connector Manufacturers:

A. 3M- "Scotchlock"

B. Buchanan - "B Cap"

C. Thomas & Betts - "Stak-On"

D. Ideal - "Wing Nuts"

E. Mechanical splices and tap connectors for feeder conductors shall be mounting block type, insulated with clamp-on molded covers that accommodate the lug types specified herein.

F. Acceptable Mechanical Connector Manufacturers:
   1. Burndy Engineering Company
   2. O-Z Gedney
   3. Thomas and Betts

G. Compression Splices: Splice conductor #8 and larger with solid copper barrel, type fittings applied with an appropriate hydraulic tool. Splices used only where approved. Splice fittings: Burndy "Hydent". Insulate splices with 600 volt, 105°C, "heat shrink", "cold shrink" covers, or taped insulation consisting of rubber, friction and vinyl tapes applied per manufacturer for 600 volt, 105°C covering.

H. Acceptable Splice and Tape Manufacturers:
   1. Burndy
   2. Thomas & Betts
   3. Ilsco
   4. Anderson
   5. Blackburn
   6. Oz/Gedney
I. Connectors and/or Terminations for Conductors #6 AWG and larger: Tin plated, 98% copper, dual crimp long barrel compression lugs with two bolt holes, insulated with molded covers to accommodate 1/2" bolts. Apply with hydraulic tool recommended by manufacturer.
   1. Acceptable Manufacturers and Products
      a. O-Z Gedney
      b. Burndy Engineering Company "Hylugs"
      c. Thomas and Betts, "Color Keyed"
      d. Anderson

J. Use pulling lubricant which will not be detrimental to insulation of conductors indicated by published user information.
   1. Acceptable Manufacturers of Lubricant:
      a. Ideal Industries
      b. Panduit Corp.
      c. OZ/Gedney
      d. Plymouth/Bishop
      e. American Polywater Corp.
      f. Thomas & Betts

K. Insulate all live joints to 600 volts with strip rubber, friction tape, and electrical vinyl tape installed in accordance with manufacturer's recommendations.
   1. Acceptable Tape Manufacturers:
      a. 3M
      b. Plymouth

L. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

M. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. For conductors #8 AWG and smaller, splice and tap connectors shall be spring connectors with molded vinyl caps. For conductors #6 AWG and larger, splice and tap connectors shall be split-bolt or compression type installed with hydraulic tool of proper capacity as recommended by the manufacturer for the size of conductor on which the connector is used.

N. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

O. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

P. Induction motors are to be terminated with bolted pressure connections and insulated with varnished cambric, then Scotch 130C rubber tape and covered with a minimum of three laps of scotch 33+ electrical tape.

2.6 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.7 SLEEVE SEALS
A. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex Co. or a comparable product by one of the following:
   1. Advance Products & Systems, Inc.
   2. Calpico, Inc.
   3. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
   1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   2. Pressure Plates: Stainless steel. Include two (2) for each sealing element.
   3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 GENERAL

A. Install electrical conductor, cables, wires, and connectors in compliance with NEC.

B. All wires shall be run in conduit or cable tray as indicated.

C. All terminations and splices shall be made in accordance with proper methods and recommendations for the type of wire and devices used and as recommended by the manufacturers of material and equipment involved.

D. Splice and tap connectors for conductors #8 AWG and smaller shall be 3-M "Scotchlok" or Ideal Industries "Super-Nut" spring connectors with molded vinyl caps.

E. Splice and tap connectors for conductors #6 AWG and larger shall be compression type installed with hydraulic tool of proper capacity as recommended by the manufacturer for the size of conductor on which the connector is used. Connector size shall be selected in accordance with manufacturer's recommendations for the size and number of wires or cables on which the connector is used.

F. All terminating connections for conductors size #6 AWG and larger shall be made with two-hole hydraulic compression type lugs.

G. Pull conductors simultaneously where more than one is being installed in same conduit. Use UL listed pulling compound or lubricant, where necessary, unless indicated otherwise in this specification or on drawings.

H. Use splice and tap connectors which are compatible with conductor material.

I. Provide adequate length of conductors within electrical enclosures and neatly train the conductors to terminal points with adequate excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations with no bare conductor showing at the terminal.

J. Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels to assure requirements are fulfilled.
K. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.

L. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

M. Clean conductor surfaces before installing lugs and connectors.

N. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.

O. Use split bolt connectors for copper conductor splices and taps, #6 AWG and larger; tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

P. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, #8 AWG and smaller.

Q. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, #10 AWG and smaller.

3.2 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 4 AWG; copper for feeders No. 4 AWG and larger. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Sizes noted on drawings are for copper.

B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Use no conductors smaller than No. 12 gauge unless specifically called for or approved by Design Engineer. Size wire for 120 volt branch Circuits for 3% maximum voltage drop. Size feeder circuits for 2 percent maximum voltage drop. Combined voltage drop of feeders and branch circuits shall not exceed 5 percent maximum.

3.3 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Wire in conduit shall be cross-linked polyethylene type XHHW.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits, below Slabs-on-Grade, and Underground: Type XHHW, cross-linked polyethylene.

G. Class 1 Control Circuits: Type THHN-THWN, in raceway.

H. Class 2 Control Circuits: Type THHN-THWN, in raceway Power-limited cable, concealed in building finishes.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

A. Run conductors in conduit continuous between outlets and junction boxes with no splices or taps pulled into conduits.
B. Neatly route, tie and support conductors terminating at switchboards, motor control centers, panelboards, sound equipment, etc., with Thomas & Betts Ty-Rap cable ties and clamps or equivalent by Electrovert or Panduit.

C. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

E. Provide factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90° bends, for pulls in conduits underground or under slabs on grade, and where indicated.

F. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

G. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

H. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."

I. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

J. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

K. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
   2. Make circuit conductor splices with Buchanan B-Cap nylon insulated connectors or equivalent by Ideal or 3M.
   3. Make fixture and device taps with Scotchlock self-stripping electrical tap connectors.
   4. Terminate solid conductors at equipment terminal strips and other similar terminal point with insulated solderless terminal connectors. Terminate all stranded conductor terminal points with insulated solderless terminal connectors. Provide Thomas & Betts Sta-Kon insulated terminals and connectors or equivalent by API/AMP Blackburn, Buchanan or Scotchlock.
   5. Where a total of six or more control and feeder conductors terminate in a multiple device panel or enclosure that has no built-in terminal blocks, provide mounting channel and see-thru covers. Equivalent terminal blocks by General Electric, Square D or Westinghouse.
   6. Wrap conductor taps and connections requiring additional insulation with a minimum of three (3) overlapped layers of 3M Scotch vinyl plastic electrical tape No. 88 or equivalent.

L. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

M. No wiring or conduit shall be placed in the concrete slab.

N. All cables 24VDC and under shall be installed in cable tray or conduit. Any conductors operating above 24VDC to be in conduit.

3.5 FIELD QUALITY CONTROL

A. Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels.

B. Prior to energizing, test wires and cables for electrical continuity and for short circuits.

C. Subsequent to wire and cable hookups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.
D. Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows: For conductors #8 and larger, provide a minimum of 10 wraps of color coded vinyl tape within 6” of conductor termination points or color coded insulation.

3.6 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

D. Cut sleeves to length for mounting flush with both wall surfaces.

E. Extend sleeves installed in floors 2 inches above finished floor level.

F. Edit paragraph below as required for Project design conditions and seismic-criteria status.

G. Size pipe sleeves to provide 0.25-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

J. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

K. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.7 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

END OF SECTION 260519
PART 1. GENERAL

1.1 WORK INCLUDES
A. Wire and Cables for Control Systems
B. Control Interlock Wiring
C. Field Fabricated Control Panels
D. Relays
E. Switches
F. Control circuits & Motor Control

1.2 SUBMITTALS
A. Submittals shall be made on all items in this section and shall be in accordance with the Division 1 - General Conditions.
B. Product Data: Submit manufacturer’s technical product data, including specifications and installation instructions, for each type of wire or cable system required. Include data substantiating that materials comply with requirements.
C. Maintenance Data: Submit maintenance data and parts lists for each type of wire or cable system installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of the General Provisions of this Specification.

PART 2. PRODUCTS

2.1 CONTROL WIRING
A. The Contractor shall provide all control wiring and connections required for a complete an operable system as specified herein and as shown on drawings. All materials and installation shall comply with requirements specified in the National Electrical Code and all applicable state and city codes and regulations.
B. Control interlock and remote indication wiring shall be #14 AWG type "THHN", except runs greater than 200 feet in length shall be #12 AWG unless noted otherwise on drawings.
C. Splice and tap connectors for conductors shall be 3-M "Scotchlok" or Ideal Industries "Super-Nut" spring connectors with molded vinyl caps. Connector size shall be selected in accordance with manufacturer's recommendations for the size and number of wires or cables on which the connector is used.
D. Contractor shall provide all control wiring and connections required for control systems. The wiring shall include the furnishing and installation of all wire, conduit, boxes, and all other necessary materials and devices required for a complete and operable installation. All materials and installation shall comply with requirements as specified herein. All wire for control circuitry shall be installed in rigid EMT conduit system and all splices and connections shall be made in boxes or device or equipment enclosures.
E. Low voltage (25 volts and under) control wiring shall not be installed in the same conduit with higher voltage circuitry wiring. Where low-voltage wiring enters the same box or enclosure with higher voltage wiring, dividers, and separation shall be provided to comply with codes and regulations, and as required to prevent malfunctions in low voltage control. Where separation of conductors for certain functions or control is recommended by the equipment or system manufacturer, then the conductors for these functions or control shall be installed in conduit separate from other conductors, regardless of voltage differential.

F. Power and 120VAC control wiring shall be single conductor, stranded (all sizes) soft annealed copper conductors with 600 volt insulation. Type THHN/THWN, Gasoline & Oil Resistant, VW-1, 75 degree C., unless noted or specified otherwise; wire smaller than No. 14 gauge shall not be used unless specifically called for on drawings.

G. Control and instrumentation 24V wiring shall be shielded twisted pair, 600V, 90-degree C:
   1. Conductors-18 AWG, stranded copper
   2. Conductor insulation of 15 mils PVC and 5 mils nylon
   3. Foil shield with tinned copper drain wire
   4. Jacket of 50 mil Black PVC
   5. Wire insulation color coded black and white

H. All control wiring shall be in accordance with color coding as shown on drawings and/or indicated below:
   1. Blue: DC control wiring
   2. Red: AC control wiring
   3. White: 120 VAC neutral
   4. Green: Equipment ground
   5. Black: 120 VAC power wiring (hot)
   6. Yellow: All control circuits or wiring which may remain energized when the main disconnecting means is in the off position
   7. Black and Clear: Shielded cable

2.2 CONTROL EQUIPMENT

A. General Requirements:
   1. All electromechanical control equipment shall be housed in a control panel as specified below.
   2. Screw-type terminals with captive saddle straps or equivalent means of retaining stranded conductors shall be provided on control devices and terminal strips.
   3. Control devices shall be marked in accordance with requirements as specified in Section 260553 and as shown on drawings.
   4. Control contacts shall be of the quick-make/quick-break type.
   5. Limit switches, pressure switches and similar devices shall have separate, isolated normally open and closed contacts, as indicated within these specifications
   6. Control relays shall be four-pole minimum, eight-pole installed maximum, unless noted or indicated otherwise on the drawings. Relays shall have a complete set of contacts (e.g., a four-pole block shall have all contacts furnished). Control relays shall be insulated for 600 volts unless specified otherwise in other Divisions of this specification.
   7. The mounting details of all control devices shall not be modified from the manufacturer's standard mounting dimensions and practices.
   8. Plug-in devices and assemblies shall be mechanically secured.

2.3 CONTROL PANELS

A. Type: Provide control panels with suitable brackets for either wall or floor mounting at locations indicated on contract drawings. Locate panel adjacent to systems served; panels to be of standard steel,
as required to contain temperature controllers, relays, switches, etc., totally enclosed, with hinged door and keyed lock; panel to be shop-painted with manufacturer's standard finish and color. Provide UL-listed cabinets for use with line voltage devices.

B. Electrical requirements: Provide electric pneumatic or pneumatic-electric switches, electrical devices, and relays that are UL-listed, and of the type which meet current and voltage characteristics of the project.

PART 3. EXECUTION

3.1 INSTALLATION

A. Install electrical conductor, cables, wires, and connectors in compliance with NEC.

B. Coordinate cable installation with other work, equipment suppliers, system manufacturers

C. Pull conductors simultaneously where more than one is being installed in same conduit. Use UL listed pulling compound, dry talc or lubricant, where necessary, unless indicated otherwise in this specification or on drawings.

D. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.

E. Conceal all cable in conduit.

F. Install cable in conduits parallel and perpendicular to surfaces or exposed structural members, and follow surface contours.

G. Keep conductor splices to minimum and provide not less than 8" slack conductors at outlet and junction boxes for splices.

H. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced, as specified hereinbefore.

I. Use splice and tap connectors which are compatible with conductor material, and meet the system manufacturer's requirements.

J. Provide adequate length of conductors within electrical enclosures and neatly train the conductors to terminal points with adequate excess. Bundle multiple conductors, cables and conductors larger than no 10 AWG cabled in individual circuits. Make terminations with no bare conductor showing at the terminal.

3.2 PROTECTION

A. This section shall apply to all equipment which operates at a supply voltage of 600 volts or less with the exception of machines powered by a single motor rated less than ¼ horsepower.

B. All protective devices shall be selected and applied with proper consideration of the inrush and normal operating current of the load as well as the thermal capacity and the short circuit with standability of the series connected devices and any equipment being protected by the device.

1. Two or more protective devices applied in series shall be selected with proper time-current and let-through energy characteristics to provide as much selective circuit protection for fault and overload conditions as possible, based on the manufacturer's data.

2. Time delay fuses shall be applied for current limiting, as well as, protection from nuisance blowing caused by inrush currents.

3. Current-limiting fuses shall be applied where the available short circuit current approaches or exceeds the momentary withstand and the interrupting capacity of the standard protective equipment.
4. Fuses for control wiring shall be time delay (dual element) types having a minimum interrupting rating of 120 percent of the maximum available system short circuit current. In no case shall the interrupting rating be less than 100,000 amperes rms symmetrical.

(a) All low voltage fuses shall be high interrupting capacity (energy limiting) and Underwriters' Laboratories listed and labeled as specified hereinafter.

5. Loads: An overcurrent device shall be connected in series with each underground leg of all branch control circuits.

(a) The overcurrent device rating shall be as low as practical and shall not exceed values specified in the following table for the smallest conductor in the branch circuit.

<table>
<thead>
<tr>
<th>Conductor Size AWG</th>
<th>Maximum Rating Amperes</th>
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<tbody>
<tr>
<td>14</td>
<td>15</td>
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<tr>
<td>12</td>
<td>20</td>
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<td>10</td>
<td>30</td>
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</table>

6. The control transformer shall be protected in the primary and secondary circuits against short circuits and overloads as specified in the following table.

<table>
<thead>
<tr>
<th>Control Transformer Size, Volt Amperes</th>
<th>Maximum Secondary Ratings Amperes</th>
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<tbody>
<tr>
<td>150</td>
<td>1.06</td>
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<tr>
<td>200</td>
<td>2.0</td>
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<td>3000</td>
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<tr>
<td>5000</td>
<td>50</td>
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</tbody>
</table>

C. For transformers larger than 5000 volt-amperes, the protective device rating shall be based on 125 percent of the secondary current rating of the transformer.

D. For primary fuse requirements, refer to NEC Section 450.

E. Each solenoid shall be considered as a separate branch circuit and shall have an overcurrent device rated at approximately 150 percent of the sealed solenoid current. The overcurrent device shall be connected between the solenoid and the control relay contact or output device. If a fuse is used, then it shall be a dual element indicating type. In the case of control by a semiconductor device, this fuse shall be supplied in addition to the normally fused output to provide coordination.

F. Under voltage protection shall be provided on all equipment which may be damaged by a continuous under voltage condition or which may initiate motion upon return of power after an under voltage condition.
3.3 **CONTROL CIRCUITS**

A. The source of the supply for the control circuit shall be taken from the load side of the main disconnecting means.

B. It is internal to the control panel enclosure.

C. The control circuit voltage shall be 120 volts AC single phase, obtained from a single transformer with an isolated secondary winding. Transformer shall have a minimum of 25% spare capacity.

D. Contact Rating:
   1. Contacts on any starter, contactor or relay shall not be used in excess of its rating. Contacts shall not be connected in parallel to increase ampacity.
   2. When surge suppressors are used to minimize electrical noise, they shall be of the diode MOV or RC type and properly rated for the application. Suppressors shall be mounted to eliminate failure of connecting leads due to vibration or exposure to physical damage.

E. Interlocking between equipment shall be provided as indicated on drawings and as required to meet the intent of the control sequences specified within this Division of the specifications.
   1. Interlocks between control circuits that are not de-energized by the same disconnecting means shall have isolated contacts, and shall be labeled as such.

F. Auxiliary light and electrical accessories are defined as work lights, enclosure lighting and convenience receptacles which are not used as control circuit voltage sources.
   1. The auxiliary lighting and electrical accessories supply voltage shall be 120V ac single phase and ground.
   2. Enclosure convenience receptacles: Enclosures which house electronic equipment shall be provided with a minimum of one (1) duplex receptacle for use with support equipment. Convenience receptacles shall be located conveniently to the electronic equipment in the control enclosure.

3.4 **LOCATION AND MOUNTING OF CONTROLS**

A. Components shall be mounted to provide mechanical clearances sufficient for mounting, wiring, adjustment, testing and replacement. Each component shall be mounted to provide heat dissipation consistent with the temperature rating of the component, adjacent components and conductors. Each component shall be arranged and oriented so that the identification may be determined without moving the component or its wiring.
   1. Equipment shall be mounted so that any component or component part can be replaced without removing the subplate. No components shall be mounted behind door pillars unless adequate space is provided for replacement and servicing.
   2. Control components shall be front mounted on a rigid metal subplate so that the complete subplate can be removed through the enclosure opening. Subplate metal shall be a minimum of 0.106 inch (MGS No. 12) nominal for mounting components with one-quarter inch diameter screws or smaller.
   3. The bottom of the subplate mounted device including terminal blocks shall not be less than 18 inches above the floor line. In no case shall the top of subplate mounted components be more than 84 inches above the floor line.
   4. A minimum of 1 inch shall be provided between the subplate components and the sides of the enclosure for proper terminal wiring and maintenance access.
   5. Subplate mounted control components shall be grouped together in one enclosure or compartment wherever possible.
   6. Any component(s) mounted on the subplate carrying line voltage or a combination of line voltage and control voltage shall be grouped above or to the side and segregated from devices which carry only the control voltage. This does not apply where the line voltage is 120 volts.
7. To minimize electromagnetic interference, solid state control and its associated wiring shall be segregated from the electromagnetic control wiring.

8. Subplate mounted control components, such as relays, starters and contactors shall be mounted in numerical order from left to right and top to bottom.

9. Terminal blocks located in compartments shall not be recessed more than 4 inches from the equipment surface. Terminal blocks shall be mounted to provide an unobstructed access to the terminals and their conductors. The blocks shall not be mounted above each other in a plane perpendicular to the subplate. Terminal strips shall not be mounted in wireways.

10. Separately mounted terminal strips shall be used for power circuits and control circuits in all enclosures. Terminal block shall be as manufactured by Allen Bradley No. 1492-HC-6 or equal Square D, General Electric, or Cutler Hammer devices and shall be furnished in quantity as required for the specific installation.

11. Ten percent spare terminals shall be provided on each subplate of every electrical enclosure and compartment. A minimum of eight spare control terminals and three spare power terminals shall be provided.

B. Mounting for electronic subassemblies and components shall be as follows:

1. Plug-in assemblies shall be mechanically secured in place with captive fasteners and keyed for proper insertion.

2. Components shall be mounted for ease of replacement and maintenance after assembly. Controls and adjustments for maintenance personnel shall be separately located from those required by operation personnel, and shall be readily accessible.

3. Transducers and associated parts shall be constructed and installed in such a manner as to provide accessibility and adequate protection against mechanical damage, degradation of performance and contamination from the environment.

3.5 FIELD QUALITY CONTROL

A. Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels to assure requirements are fulfilled.

B. Prior to energizing, test wires and cables for electrical continuity and for short circuits.

C. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

END OF SECTION 260523
SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes methods and materials for grounding systems and equipment. Provide a grounding system as required by the National Electric Code (NEC) and local authorities.

1.2 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS
A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
B. Bare Copper Conductors:
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 0.25-inch in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1.625 inches wide and 0.0625-inch thick.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1.625 inches wide and 0.0625-inch thick.

2.2 CONNECTORS
A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.
C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES
A. Ground Rods: Copper-clad steel 0.75-inch by 10 feet in diameter.
PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid or stranded conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 3/0 AWG minimum. Bury at least 24 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three (3) bands of green and two bands of yellow.

D. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits (exterior only) and (dimming circuits).
   3. Receptacle circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Metal-clad cable runs.
   8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
E. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 0.25-inch by 2-inch by 12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

F. Ground secondary services at supply side of each individual secondary disconnecting means and at related transformers in accordance with NEC. Provide each service disconnect enclosure with neutral disconnecting means which interconnect with insulated neutral and uninsulated equipment ground sub to establish system common ground point. Neutral disconnecting links shall be located so that low voltage neutral bar with interior secondary neutrals can be isolated from common ground bus and service entrance conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three (3) rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor. Rods shall be interconnected by a minimum 3/0 bare copper conductor brazed to each ground rod below grade.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building’s main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on building side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
   a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 5 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526
SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes:
      1. Hangers and supports for electrical equipment and systems.
      2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS
   A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis
      by a qualified professional engineer, using performance requirements and design criteria indicated.
   B. Design supports for multiple raceways capable of supporting combined weight of supported systems
      and its contents.
   C. Design equipment supports capable of supporting combined operating weight of supported equipment
      and connected systems and components.
   D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or
      imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 QUALITY ASSURANCE
   A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS
   A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
      1. Manufacturers: Subject to compliance with requirements, provide products by one of the
         following:
            a. Cooper B-Line, Inc.; a division of Cooper Industries.
            b. Thomas & Betts Corporation.
            c. Unistrut; Tyco International, Ltd.
      2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
      3. Nonmetallic Coatings: Manufacturer’s standard PVC, polyurethane, or polyester coating applied
         according to MFMA-4.
      4. Painted Coatings: Manufacturer’s standard painted coating applied according to MFMA-4.
      5. Channel Dimensions: Selected for applicable load criteria.
   B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
   C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings,
      designed for types and sizes of raceway or cable to be supported.
   D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body
      and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits.
      Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual
      conductors or cables supported. Body shall be malleable iron.
E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Cooper B-Line, Inc.; a division of Cooper Industries.
         2) Hilti Inc.
         3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         4) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.


2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Support vertical and horizontal conduit runs at intervals not greater than 10 feet, within 3 feet of any bend and at every outlet or junction box. Where plastic conduit is used, follow E/M’s recommended hangar spacing.
C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 0.25-inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with single-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1.5-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 pounds.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.
3.4 CONCRETE BASES
A. Construct concrete bases of dimensions 4 inches thick or as otherwise indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete and Miscellaneous Cast-in-Place Concrete."
C. Anchor equipment to concrete base.
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING
A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
D. All conduit raceways and cable trays where exposed in finish space shall be painted to match attached surface or material.

END OF SECTION 260529
SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS
A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.
C. Comply with applicable requirements of UL 50, UL 514 Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING
A. Rigid Steel Conduit: Hot dipped galvanized with clear lacquer finish complying with ANSI C80.1.
B. PVC coated rigid metal conduit complying with ANSI C80.1, UL 6 and NEMA RN-1. Match existing used at for OR Isolation Panel circuits.
C. EMT: Thin wall with electro-galvanized and clear lacquer finish complying with ANSI C80.3.
D. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
   2. Fittings for EMT: Steel, compression type.

2.2 NONMETALLIC CONDUIT AND TUBING
B. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper B-Line, Inc.
   2. Hoffman.
   3. Square D; Schneider Electric.
B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, as indicated.
C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Flanged-and-gasketed type.

E. Finish: Manufacturer’s standard enamel finish.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer’s standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Thomas & Betts Corporation.
   c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer’s standard colors.

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

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Butler Manufacturing Company; Walker Division.
   b. Hubbell Incorporated; Wiring Device-Kellems Division.
   c. Lamson & Sessions; Carlon Electrical Products.
   d. Panduit Corp.
   e. Walker Systems, Inc.; Wiremold Company (The).
   f. Wiremold Company (The); Electrical Sales Division.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

C. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer’s standard enamel.


G. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer’s standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.
PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Comply with the following applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
   a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   b. Mechanical rooms.
   c. Electrical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: Rigid steel conduit.
6. Raceways for Optical Fiber or Communications Cable: EMT.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

B. EMT Conduit shall be provided for the following application where cable is installed in occupied area without ceiling or cable tray, and in walls to above ceiling:

1. Data and telephone wiring
2. Intercom
3. Fire Alarm
4. Security System
5. Cable TV
6. DDC control wiring

C. Minimum Raceway Size: 0.75-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. Setscrew fittings shall not be allowed.

E. Short runs of flexible conduit may be used where permitted by code. Lengths greater than 6 feet require prior approval by engineer.

F. Plastic conduit shall not be used above grade for any purpose.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation. Provide insulated throat fittings prior to conductor installation. Failure to do so may result in re-pulling of wiring.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. Install exposed conduit parallel or at right angles to building lines. Install all conduit in neat, workman like manner.

H. Make conduit connection to motors and equipment on resilient mounts with liquid-tight flexible conduit.

I. Where conduits cross building expansion joints, provide expansion fittings as required.

J. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Change from ENT to rigid steel conduit, before rising above the floor.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

M. All below grade non-metallic conduit shall be provided with tracer wire.

N. Raceways for Optical Fiber and Communications Cable: Install as follows:
   1. 0.75-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
   2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
   3. Install with a maximum of two (2) 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

P. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Q. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

R. Set metal floor boxes level and flush with finished floor surface.

3.3 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260533
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
2.2 METAL-CLAD CABLE IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
B. Colors for Raceways Carrying Circuits at 600 V and Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage and system or service type.
C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
   2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
D. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
E. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS
A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
D. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
   2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE
A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
2.6 WARNING LABELS AND SIGNS
   A. Comply with NFPA 70.
   B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
   C. Baked-Enamel Warning Signs:
      1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
      2. 0.25-inch grommets in corners for mounting.
      3. Nominal size, 7 by 10 inches.
   D. Warning label and sign shall include, but are not limited to, the following legends:
      1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
      2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.7 INSTRUCTION SIGNS
   A. Engraved, laminated acrylic or melamine plastic, minimum 0.625-inch thick for signs up to 20 sq. inches and 0.125-inch thick for larger sizes.
      1. Engraved legend with black letters on white face.
      2. Punched or drilled for mechanical fasteners.
      3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
   B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 0.375-inch.
   C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 0.375-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS
   A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 0.375-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
   B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 0.375-inch.
   C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS
   A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
   B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 30-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
   2. Power.

C. Junction Boxes: All junction boxes containing emergency feeder branch circuits shall be painted with colors indicated below. ALL sides of the junction box shall be painted to allow easy identification, including cover.
   1. Orange – Critical Branch
   2. Red Stripe – Life Safety Branch
   3. Yellow – Equipment Branch

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
   1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
      a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Control/Instrumentation Wire:

1) 120VAC control signal: Red
2) 120VAC line power: Black
3) 120VAC line neutral: White
4) Grounds: Green
5) DC ungrounded Control Circuits: Blue
6) DC grounded Control Circuits: White with Blue stripe
7) Analog Pair: Black/White or Black/Red
8) Instrument signal Cable Jacket: Black or Gray
9) RTD V+ (device): Black
10) RTD V- (device): White
11) RTD compensation (device): Red
12) Externally powered: Orange
13) Intrinsically Safe: Light Blue

c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
   a. Power transfer switches.
   b. Controls with external control power connections.

I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:

   TYPE 1: Laminated phenolic plastic with black Gothic-condensed lettering by Seaton or Wilco.

   TYPE 2: Self-sticking 0.5-inch wide flexible nylon tape with high gloss surface and typed smearproof, chemical/solvent resistant lettering by Brady or Dymo.

   TYPE 3: Self-sticking polyester sign with wording and size conforming to ANSI Standard Z35.1 - 1964 and OSHA 19.0.144iii(2) Specifications, by Brady or as approved.

   TYPE 4: Self-sticking flexible vinyl with oil resistant adhesive for -20 degrees to 300 degrees F. temperatures by Brady or as approved.

   a. Provide switchboards with Type 1 signs 2.5 inches x 12 inches indicating switchboards designation and electrical characteristics as noted on drawings. Provide switchboards sections operating at different voltages with Type I sign 2 inches by 8 inches indicating electrical characteristics of section. Provide each switchboard device with Type 1 sign 1.25 inches by 5 inches indicating load served.

   b. Provide distribution panelboards with Type 1 signs 2 inches by 8 inches indicating panel designation and electrical characteristics. Provide branch devices with Type 1 sign 1 inch by 4 inches indicating load served.

   c. Provide lighting and power panelboards with Type 1 sign 1.25 inches by 6 inches indicating panel designation, electrical characteristics, and source of power. Source of power indication shall indicate source panel designation and switch or breaker number. Mount inside of panel door on circuit breaker trim flange just below breakers.

   d. Provide disconnect switches, time switches, lighting contactors, motor starters and controllers with Type 1 sign 1.25 inches by 6 inches indicating equipment served, electrical characteristics, and source of power.

   e. Provide feeders and branch circuit home runs with Type 4 wire marker indicating circuit number and power source. Provide feeders phase identification letter at each terminal point in addition to its circuit number.

   f. Provide Type 2 tape at feeder terminal lugs to switchboards and panelboards. Tape shall indicate conduit size, conductor type and AWG size. Tape shall be located to be easily read with conductors installed.

K. Panelboard Labeling:

   1. Contractor shall provide new circuit directories at all panelboards in which a load alteration has occurred. Labels shall be typed, posted to the inside of the panelboard door and indicate all new and existing loads. Existing loads that have been removed shall be labeled as “spare”. Existing loads that have been altered (reused or added) shall be indicate the (new) load served on the directory.

END OF SECTION 260553
SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following lighting control devices:
   1. Time switches.
   2. Outdoor photoelectric switches.
   3. Indoor occupancy sensors.
   4. Outdoor motion sensors.
   5. Lighting contactors.
B. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Field quality-control test reports.
C. Operation and maintenance data.

1.3 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 TIME SWITCHES
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Intermatic, Inc.
   3. Lithonia Lighting; Acuity Lighting Group, Inc.
   5. Square D; Schneider Electric.
   6. TORK.
   7. Watt Stopper (The).
B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
   1. Contact Configuration: DPST.
   2. Contact Rating: 20-A ballast load, 120/240-V ac.
   3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
   4. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
   5. Programs: 6 channels; each channel shall be individually programmable with 8 on-off set points on a 24-hour schedule.
6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
7. Battery Backup: For schedules and time clock.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION
A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 0.5-inch.
B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION
A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
B. Label time switches and contactors with a unique designation.

3.3 FIELD QUALITY CONTROL
A. Perform the following field tests and inspections and prepare test reports:
1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 260923
SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS
A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.
   8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.
C. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
D. Panelboard schedules for installation in panelboards.
E. Operation and maintenance data.

1.4 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with NEMA PB 1.
C. Comply with NFPA 70.
PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
B. Enclosures: Flush- and surface-mounted cabinets dead front design.  
1. Rated for environmental conditions at installed location.  
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.  
   b. Outdoor Locations: NEMA 250, Type 3R with gasketed door and lock assembly with all locks keyed alike.  
   c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.  
2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.  
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.  
C. Incoming Mains Location: Top and bottom.  
D. Phase, Neutral, and Ground Buses: Tin-plated hard-drawn copper, 98 percent conductivity.  
E. Conductor Connectors: Suitable for use with conductor material and sizes.  
   2. Main and Neutral Lugs: Mechanical type.  
   3. Ground Lugs and Bus Configured Terminators: Mechanical type.  
   4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.  
   5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.  
F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.  
G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.  
H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.  

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS  
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:  
   1. Square D; a brand of Schneider Electric.  
   2. Cutler Hammer / Eaton  
   3. Siemens  
   4. General Electric  
B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.  
C. Mains: Circuit breaker or lugs only with field convertible top or bottom feeds for incoming feed.  
D. Minimum short circuit current rating of 22,000 in rms symmetrical amperes unless otherwise indicated.  
E. Provide one continuous plated copper bus bar per phase. Provide solidly bonded copper equipment bus bar and additional isolated/insulated ground bar as specified.
F. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

H. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.


3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).


8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Shunt Trip: (Voltage as prepared by Siemens) trip coil energized from separate circuit, set to trip at percent of rated voltage - As required by Siemens.
   g. Handle Clamp: Loose attachment for holding circuit-breaker handle in on position.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.
PART 3 - EXECUTION

3.1 INSTALLATION
A. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
B. Mount top of trim 90 inches above finished floor unless otherwise indicated.
C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
D. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.
E. Install filler plates in unused spaces.
F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION
A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL
A. Perform tests and inspections.
B. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.
C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
D. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION 262416
SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Wall-box motion sensors.
   3. Snap switches and wall-box dimmers.
   4. Solid-state fan speed controls.
   5. Wall-switch and exterior occupancy sensors.
   6. Communications outlets.

B. See Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.2 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 RECEPTACLES

A. Provide receptacles with automatic self-grounding clip, back and side wired with clamp-type terminals and additional features. Comply with UL 498 and NEMA WD 1. Receptacles shall be 120V, 20A, heavy duty grade.
2.3 **INDUSTRIAL HEAVY DUTY RECEPTACLES**
   
   A. Provide pin and sleeve design receptacles conforming to UL 498. Comply with UL 1010 where installed in hazardous locations. Provide features indicated.

2.4 **GFCI RECEPTACLES**
   
   A. Provide “feed-thru” type ground-fault circuit interrupter, with integral heavy-duty NEMA 5-20R duplex receptacles, test button, LED indicator lamp, and reset button arranged to protect connected downstream receptacles on same circuit. Provide unit designed for installation in a 2-3/4" deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 94.3, heavy duty industrial grade.

2.5 **SNAP SWITCHES**
   
   A. Comply with NEMA WD 1 and UL 20.

   B. Switches, 120/277 V, 20 A:

   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   2. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).

      b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).

      c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).

      d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

   C. Pilot Light Switches, 20 A:

   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   2. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; 2221PL for 120 V and 277 V.

      b. Hubbell; HPL1221PL for 120 V and 277 V.

      c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.

      d. Pass & Seymour; PS20AC1-PLR for 120 V.

   3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:

   2. Products: Subject to compliance with requirements, provide one of the following:


      b. Hubbell; HBL1557.

      c. Leviton; 1257.

      d. Pass & Seymour; 1251.

2.6 **FAN SPEED CONTROLS**
   
   A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.

   1. Continuously adjustable slider, 5 A.

   2. Three-speed adjustable slider, 1.5 A.
2.7 COMMUNICATIONS OUTLETS
A. Telephone Outlet:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:
2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.

2.8 WALL PLATES
A. Single and combination, of types, sizes, and with gangin and cutouts as required. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide white color wall plates except in clean room, process areas or unfinished areas as indicated below. Provide wall plates with engraved legend or micarta label indicating panel and circuit number. Provide plates possessing the following additional construction features in clean rooms and process areas:
   1. Clean Room
      a. Receptacle covers shall be specification grade grey polycarbonate, single lid covers with stainless steel hinges, gasket and stainless steel screws and of the in use type.
      b. Switch covers shall be 0.04” thick, type 304 satin finished stainless steel with flexible silicone bubble for switch actuation, with gasket and stainless steel screws. Pass & Seymour 4516 or equal.
   2. Mechanical Room
      a. Wall plates shall be type 430 satin finish stainless steel
   3. Unfinished Room
      a. Wall plates shall be galvanized steel.

2.9 FINISHES
A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
B. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.
C. Conductors:
   1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtailed.

4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtauling existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtailed that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtailed for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversize or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 114 to 126 V.
2. Percent Voltage Drop under 15-A Load: A value of higher than 5% is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION 262726
SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Non-fusible switches.
   2. Receptacle switches.
   3. Shunt trip switches.
   4. Molded-case circuit breakers (MCCBs).
   5. Enclosures.

1.2 DEFINITIONS
A. NC: Normally closed.
B. NO: Normally open.
C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS
A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS
A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.
C. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
D. Operation and maintenance data.

1.5 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with NFPA 70.

PART 2 - PRODUCTS
2.1 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three (3) padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
   3. Lugs: Suitable for number, size, and conductor material.

2.2 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.


D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Instantaneous trip.
   2. Long- and short-time pickup levels.
   3. Long- and short-time time adjustments.
   4. Ground-fault pickup level, time delay, and I^2t response.

E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

F. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
   4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-
test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Auxiliary Contacts: One (1) SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
7. Alarm Switch: One (1) NO contact that operates only when circuit breaker has tripped.

2.3 ENCLOSURES
A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R.
   4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
   5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
D. Install fuses in fusible devices.
E. Comply with NECA 1.

3.2 IDENTIFICATION
A. Comply with requirements in Division 26 Section 260533, "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL
A. Perform tests and inspections.
B. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.
C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816
SECTION 265100 - INTERIOR LIGHTING

1.1 SUMMARY
A. This Section includes the following:
   1. Interior lighting fixtures, lamps, and ballasts.
   2. Emergency lighting units.
   3. Exit signs.
   4. Lighting fixture supports.
B. See Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 SUBMITTALS
A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes.
B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
C. Field quality-control test reports.

1.3 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Basis-of-Design Product: The design for each lighting fixture is based on the product named in the schedule. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified in the schedule.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS
A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
D. Metal Parts: Free of burrs and sharp corners and edges.
E. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
G. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

H. Plastic Diffusers, Covers, and Globes:
   1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
      a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
      b. UV stabilized.
   2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 BALLASTS

A. Electronic Ballasts for Linear Fluorescent Lamps: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.
   1. Sound Rating: A.
   2. Total Harmonic Distortion Rating: Less than 10 percent.
   3. Transient Voltage Protection: IEEE C62.41, Category A or better.
   4. Operating Frequency: 20 kHz or higher.
   5. Lamp Current Crest Factor: 1.7 or less.
   6. BF: 0.85 or higher.
   7. Power Factor: 0.95 or higher.

B. Ballasts for Compact Fluorescent Lamps: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
   1. Lamp end-of-life detection and shutdown circuit.
   2. Automatic lamp starting after lamp replacement.
   3. Sound Rating: A.
   4. Total Harmonic Distortion Rating: Less than 20 percent.
   5. Transient Voltage Protection: IEEE C62.41, Category A or better.
   6. Operating Frequency: 20 kHz or higher.
   7. Lamp Current Crest Factor: 1.7 or less.
   8. BF: 0.95 or higher, unless otherwise indicated.
   9. Power Factor: 0.95 or higher.
   10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

C. Internal-Type Emergency Fluorescent Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
   1. Emergency Connection: Operate 1 fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
   2. Night-Light Connection: Operate one fluorescent lamp continuously (if specifically indicated on drawing only).
   3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
      a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type rated for 90 minute operation minimum.

5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.4 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type rated for automatic 90 minute operation minimum.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.5 LAMPS

A. Low-Mercury Fluorescent Lamps: Comply with EPA’s toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. T5 Rapid-Start low-mercury Fluorescent Lamps: Rated 28 W maximum, nominal length 48 inches, 2800 initial lumens (minimum), CRI 78 (minimum), color temperature 3500 K, and average rated life 24,000 hours, unless otherwise indicated.

C. T5 Rapid-Start low-mercury Fluorescent Lamps: Rated 14 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 78 (minimum), color temperature 3500 K, and average rated life of 24,000 hours, unless otherwise indicated.

D. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).

2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).

3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).

4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).

5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).

6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).
2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section 260529, "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 0.5-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two (2), 0.5-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.


E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.

F. Rod Hangers: 0.1875-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture. Contractor shall coordinate fixture mounting with architectural ceiling type to verify compatibility.

B. Comply with NFPA 70 and NEC section 410 for minimum fixture supports.

C. Suspended Lighting Fixture Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

F. Hand indirect light fixture by use of aircraft cable unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100
SECTION 265600 - EXTERIOR LIGHTING

PART 1. GENERAL

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

1.2 SUMMARY
A. This Section includes exterior lighting units with luminaires, lamps, ballasts, poles/support structures, and accessories.
B. Related Sections include the following:
   1. Division 26 Section 265100, "Interior Lighting" for interior fixtures, lamps, ballasts, emergency lighting units, and accessories; and for exterior luminaires normally mounted on buildings.
   2. Division 26 Section "Lighting Control Equipment" for programmable lighting control systems, time switches, additional photoelectric relays, power relays, and contactors.

1.3 DEFINITIONS
A. Lighting Unit: A luminaire or an assembly of luminaires complete with a common support, including pole, post, or other structure, and mounting and support accessories.
B. Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

1.4 SUBMITTALS
A. Product Data: For each type of lighting unit indicated, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
   1. Materials and dimensions of luminaires and poles
   2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data
   3. Certified results of laboratory tests for fixtures and lamps for photometric performance
   4. High-intensity-discharge luminaire ballasts.
B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.
C. Samples for Verification: For lighting units or luminaires designated for sample submission in the Exterior Lighting Unit Schedule.
   1. Lamps: Specified units installed.
   2. Ballast: 120-V or 208-V/277-V or 480-V model of specified ballast type.
   3. Finishes: For each finished metal used in support components.
D. Product Certificates: Signed by manufacturers of lighting units certifying that products comply with requirements.
E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
F. Maintenance Data: For lighting units to include in maintenance manuals specified in Division 1.
1.5 QUALITY ASSURANCE
A. Luminaires and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use, location, and installation conditions by a testing agency acceptable to authorities having jurisdiction.
B. Comply with ANSI C2.
C. Comply with NFPA 70.
D. FM Compliance: Units for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.

1.6 DELIVERY, STORAGE, AND HANDLING OF POLES
A. Package aluminum poles for shipping according to ASTM B 660.
B. Store poles on decay-resistant treated skids at least 12 inches above grade and vegetation; support poles to prevent distortion and arrange to provide free air circulation.
C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent surface more than 1/4 inch deep. Do not apply tools to section of poles below ground-line.
D. Retain factory-applied pole wrappings on fiberglass poles until just before pole installation. Handle poles with web fabric straps.
E. Retain factory-applied pole wrappings on metal poles until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.7 WARRANTY
A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
B. Special Warranty: Written warranty, signed by manufacturer and Installer agreeing to replace external parts of luminaires and poles exhibiting a failure of finish as specified below. This warranty is in addition to, and not a limitation of, other rights and remedies Owner may have under requirements of the Contract Documents.
   1. Protection of Metal from Corrosion: Warranty against perforation or erosion of finish due to weathering
   2. Color Retention: Warranty against fading, staining, and chalking due to effects of weather and solar radiation
   3. Warranty Period: Manufacturer's standard, but not less than three years from date of Substantial Completion

1.8 EXTRA MATERIALS
A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
   4. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.
PART 2. PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each
designation in the Exterior Lighting Unit Schedule at the end of Part 3.

1. Equal by Sternberg, Architectural Area Lighting, ANP lighting

2.2 LUMINAIRES

A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

B. Metal Parts: Free from burrs, sharp corners, and edges.

C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated; form and support
to prevent warping and sagging.

D. Housings: Rugged cast aluminum, rigidly formed, weather- and light-tight enclosures that will not warp,
sag, or deform in use. Provide filter/breather for enclosed luminaires.

E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating
conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses,
diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating
position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when
door opens.

F. Weather-tight LED driver compartments with high performance aluminum heatsinks.

G. Exposed Hardware Material: Stainless steel

H. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent
2. Specular Surfaces: 83 percent
3. Diffusing Specular Surfaces: 75 percent

I. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal
and cushion lens and refractor in luminaire doors.

J. Electrical: As follows:

1. LED Light sources: Modular design to accommodate varied lighting output from high power,
white, 6000K (+/-500K per full fixture), minimum 70 CRI, long life LED sources. 120-277V 50/60
Hz, class 1 LED drivers shall be standard. LED drivers shall have a power factor >90% and THD
<15% of full load. Units shall be provided with integral 9kV surge suppression protection as
standard. Integral weather-tight electrical box with terminal strip for easy power hook-up shall
be provided.

2. Provide two-level light control with 175mA / 525mA drive current with integrated occupancy
sensor control. Minimum lamp life with 175 driver shall be 150,000 hours plus, and greater than
70,000 hours with 525mA driver.

K. Lamps: Comply with the standard of the ANSI C78 series that is applicable to each type of lamp.
Provide luminaires with indicated lamps of designated type, characteristics, and wattage. Where a lamp
is not indicated for a luminaire, provide medium wattage lamp recommended by manufacturer for
luminaire.

L. Accessories: as indicated in the schedule
2.3 LUMINAIRE SUPPORT COMPONENTS

A. Description: Comply with AASHTO LTS-3 for pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.

B. Wind-Load Strength of Total Support Assembly: Adequate to carry support assembly plus luminaires at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 100 mph (160 km/h) with a gust factor of 1.3. Support assembly includes pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.

1. Strength Analysis: For each pole type and luminaire combination, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

C. Finish: Match finish of pole/support structure for arm, bracket, and tenon mount materials.

D. Luminaire mounting: Adjustable mounting arm made of rugged die cast aluminum which mounts to 2" tenon.

E. Leaf/debris guard: included

F. Coordinate paragraph and subparagraphs below with Drawings.

G. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Will not cause galvanic action at contact points.
2. Mountings: Correctly position luminaire to provide indicated light distribution.
3. Anchor Bolts, Nuts, and Washers: Hot-dip galvanized after fabrication unless stainless-steel items are indicated.
4. Anchor-Bolt Template: Masonite or steel.

H. Select one of three pole bases below.

I. Pole/Support Structure Bases: Anchor type with hold-down or anchor bolts, leveling nuts, and bolt covers.

J. Steel Poles: Tubing complying with ASTM A 500, Grade B, carbon steel with a minimum yield of 42,000 psig; one-piece construction up to 40 feet in length with access handhole in pole wall.

K. Metal Pole Brackets: Match pole metal. Provide cantilever brackets without underbrace, in sizes and styles indicated, with straight tubular end section to accommodate luminaire.

L. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

M. Concrete for Pole Foundations: Comply with Division 3 Section "Cast-in-Place Concrete."

1. Design Strength: 3000-psig, 28-day compressive strength.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Aluminum Luminaire: Exclusive colorfast DeltaGuard finish which shall feature an E-Coat epoxy primer with an ultradurable silver power topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion (or color as selected on plans). The finish shall have 10 year limited warranty.
C. Steel pole: Grind welds and polish surfaces to a smooth, even finish.
   1. Galvanized Finish: Hot-dip galvanize after fabrication to comply with ASTM A 123.
   2. Select subparagraph above for plain galvanized finish or three subparagraphs and associated
      subparagraphs below for factory-painted finish.
   3. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove
dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and
rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast
Cleaning," or SSPC-SP 8, "Pickling."
   4. Interior: Apply one coat of bituminous paint on interior of pole, E-coat primer, or otherwise treat
to prevent corrosion.
   5. Polyurethane Enamel / Ultra-durable powder topcoat: Manufacturer's standard finish consisting
of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane
enamel.
      (a) Color: As indicated in the light fixture schedule.
      (b) Warranty: pole finish shall have a 7-year limited warranty.

PART 3. EXECUTION

3.1 INSTALLATION
   A. Concrete Foundations: Construct according to Division 3 Section "Cast-in-Place Concrete."
      1. Comply with details for reinforcement and for anchor bolts, nuts, and washers. Verify anchor-
bolt templates by comparing with actual pole bases furnished.
      2. Finish for Parts Exposed to View: Trowel and rub smooth. Comply with Division 3 Section "Cast-
in-Place Concrete" for exposed finish.
   B. Embedded Poles: Set poles to indicated depth, but not less than one-sixth of pole length below finish
grade. Dig holes large enough to permit use of tampers the full depth of hole. Backfill in 6-inch (150-
mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of
undisturbed earth.
   C. Install poles as follows:
      1. Use web fabric slings (not chain or cable) to raise and set poles.
      2. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended
by pole manufacturer.
      3. Secure poles level, plumb, and square.
      4. Grout void between pole base and foundation. Use nonshrinking or expanding concrete grout
firmly packed in entire void space.
      5. Use a short piece of 1/2-inch diameter pipe to make a drain hole through grout. Arrange to drain
condensation from interior of pole.
   D. Luminaire Attachment: Fasten to indicated structural supports.
   E. Luminaire Attachment with Adjustable Features or Aiming: Attach luminaires and supports to allow
aiming for indicated light distribution.
   F. Lamp luminaires with indicated lamps according to manufacturer's written instructions; replace
malfunctioning lamps.

3.2 CONNECTIONS
   A. Ground Equipment
1. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Ground metal poles/support structures according to Division 26 Section 260526, "Grounding and Bonding of Electrical Systems."
   1. Nonmetallic Poles: Ground metallic components of lighting units and foundations. Connect luminaires to grounding system with No. 6 AWG conductor.

3.3 FIELD QUALITY CONTROL
A. Inspect each installed unit for damage. Replace damaged units.
B. Advance Notice: Give dates and times for field tests.
C. Provide instruments to make and record test results.
D. Tests and Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source, and as follows:
   1. Measure light intensities at night if specific illumination performance is indicated; use photometers with calibration referenced to NIST standards.
   2. Check intensity and uniformity of illumination.
   3. Check excessively noisy ballasts.
E. Prepare a written report of tests, inspections, observations and verifications indicating and interpreting results.
F. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.4 CLEANING AND ADJUSTING
A. Clean units after installation. Use methods and materials recommended by manufacturer.
B. Adjust amiable luminaires and luminaires with adjustable lamp position to provide required light distributions and intensities.

END OF SECTION 265600