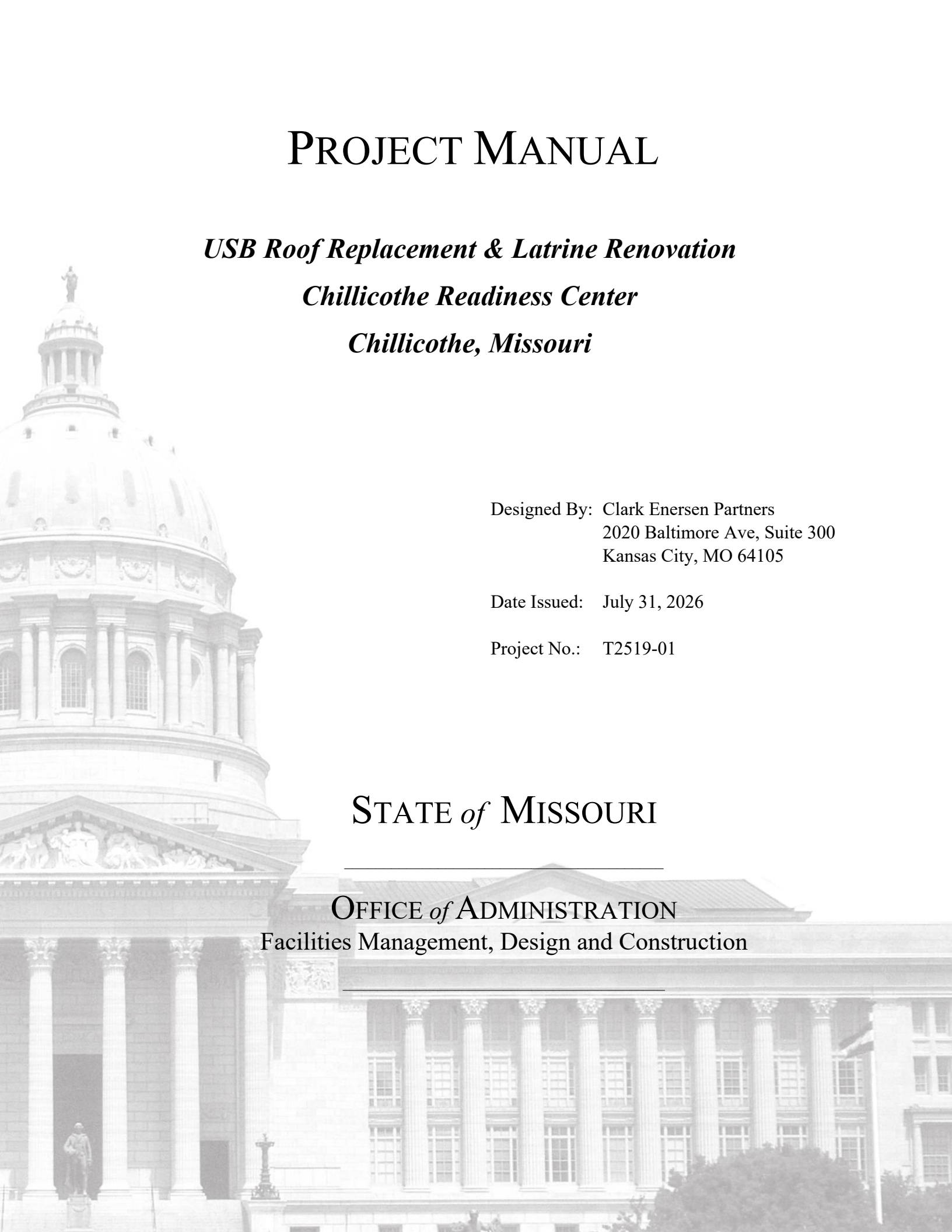




PROJECT MANUAL

USB Roof Replacement & Latrine Renovation

Chillicothe Readiness Center

Chillicothe, Missouri

Designed By: Clark Enersen Partners
2020 Baltimore Ave, Suite 300
Kansas City, MO 64105

Date Issued: July 31, 2026

Project No.: T2519-01

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION

Facilities Management, Design and Construction

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: (T2519-01 "Chillicothe Readiness Center, USB Roof Replacement & Latrine Renovation")

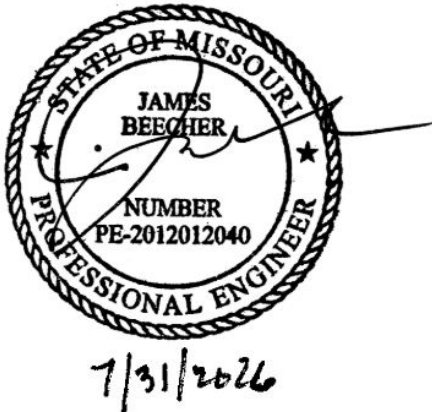
THE FOLLOWING DESIGN PROFESSIONALS HAVE SIGNED AND SEALED THE ORIGINAL PLANS AND SPECIFICATIONS FOR THIS PROJECT, WHICH ARE ON FILE WITH THE DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION:



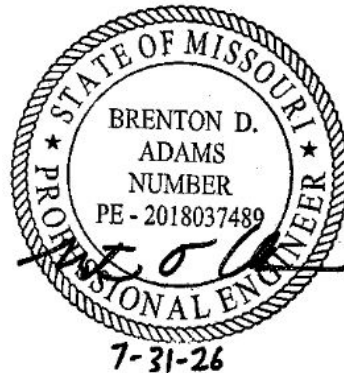
LANDSCAPE ARCHITECT



ARCHITECT



MECHANICAL ENGINEER



ELECTRICAL ENGINEER

Certificate of Authority to Offer Architectural Services: #A-2005030713-F

Certificate of Authority to Offer Engineering Services: #E-2005030491-F

Certificate of Authority to Offer Landscape Architectural Services: #LA-2005029859-D

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SECTION 00 01 15 – 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:

	<u>TITLE</u>	<u>SHEET #</u>	<u>DATE</u>
1.	Title Sheet	Sheet G-000	07/31/26
2.	General Notes, Symbols, Abbreviations & and Drawing Index	Sheet G-001	07/31/26
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17.	Wall Sections - USB Building	Sheet A-400	07/31/26
18.	Interior Elevations, Schedules & Details	Sheet A-500	07/31/26
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21.	First Floor HVAC Plans	Sheet M-101	07/31/26
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28.	Plumbing Schematics	Sheet P-301	07/31/26
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33.	Electrical Plans	Sheet E-101	07/31/26
34.	Electrical Schedules	Sheet E-201	07/31/26
35.	Electrical Details	Sheet E-301	07/31/26

END OF SECTION 00 01 15

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. USB Roof Replacement and Latrine Renovation
Chillicothe Readiness Center
Chillicothe, Missouri
Project No.: T2519-01

3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, September 8, 2026
- B. **Only electronic bids sent to FMDCBids@oa.mo.gov shall be accepted:** (See Instructions to Bidders for further detail)

4.0 DESCRIPTION:

- A. Scope: The Work consists of renovating a break room into new women's locker room and roof replacement of USB Building.
- B. MBE/WBE/SDVE Goals: MBE 0%, WBE 0%, and SDVE 3%. **NOTE: Only MBE/WBE firms certified by the State of Missouri Office of Equal Opportunity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.**

5.0 PRE-BID MEETING:

- A. Place/Time: 10:00 AM, August 26, 2026, at Chillicothe Readiness Center 1500 Washington Street US Hwy. 65 North Chillicothe, MO
- B. Access to State of Missouri property requires presentation of a photo ID by all persons.

6.0 HOW TO GET PLANS & SPECIFICATIONS:

- A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of \$100.00 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, <https://www.adsplanroom.net>. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate. Additional bid sets or parts thereof may be obtained by any bidder at the cost of printing and shipping by request to American Document Solutions at the address shown above. Bidder must secure at least one bid set to become a planholder.
- B. **Refunds: Return plans and specifications in unmarked condition within 15 working days of bid opening to American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433. Deposits for plans not returned within 15 working days shall be forfeited.**
- C. Information for upcoming bids, including downloadable plans, specifications, Invitation for Bid, bid tabulation, award, addenda, and access to the ADS planholders list, is available on the Division of Facilities Management, Design and Construction's web site: <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

7.0 POINT OF CONTACT:

- A. Project Manager: Nathan Graessle, 573-508-6646, email: nathaniel.graessle@oa.mo.gov

8.0 GENERAL INFORMATION:

- A. The State reserves the right to reject any and all bids and to waive all informalities in bids. No bid may be withdrawn for a period of 20 working days subsequent to the specified bid opening time. The contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations and as set out in the detailed plans and specifications.
- B. Bid results will be available at <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans> after it is verified that at least one bid is awardable and affordable.

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 must adhere to requirements in Section 013513 – Site Security and Health Requirements as applicable per Agency.
- B. The Bidder's prices shall include all city, state, and federal sales, excise, and similar taxes that may lawfully be assessed in connection with the performance of work, and the purchased of materials to be incorporated in the work. **THIS PROJECT IS NOT TAX EXEMPT.**

2.0 - BID DOCUMENTS

- A. The number of sets obtainable by one (1) party may be limited in accordance with available supply.
- B. For the convenience of contractors, subcontractors and suppliers, bidding documents are available on the Owner's website at <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

3.0 - BIDDERS' OBLIGATIONS

- A. Bidders must carefully examine the entire site of the work and shall make all reasonable and necessary investigations to inform themselves thoroughly as to the facilities available as well as to all the difficulties involved in the completion of all work in accordance with the specifications and the plans. Bidders are 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 successful Bidder (contractor) to fulfill every detail of the requirements of the contract, nor accepted as a basis for any claims for extra compensation or time extension.
- B. Under no circumstances will Bidders give their plans and specifications to other Bidders. It is highly encouraged, but not required, that all Bidders be on the official planholders list to receive project updates including but not limited to any addenda that are issued during the bidding process.

4.0 - INTERPRETATIONS

- A. No Bidder shall be entitled to rely on oral or written representations from any person as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction.
- B. Bidders shall make all requests for interpretations in writing and submit all requests to the Project Manager identified in Section 007300 – Supplementary Conditions with all necessary supporting documentation no less than five (5) working days before opening of bids. Responses to requests for interpretation will be issued via a written addendum and will be sent as promptly as is practicable to all official planholders and posted on the Owner's website. All such addenda shall become part of the bid and contract documents.
- C. Bidders shall make all requests for an "Acceptable Substitution" on the Section 006325 Substitution Request Form. The request shall be emailed to the Project Manager identified in Section 007300 – Supplementary Conditions no less than five (5) working days before opening of bids. Responses to requests for substitutions will be issued via a written addendum and will be sent as promptly as is practicable to all official planholders and posted on the Owner's website. All such addenda shall become part of the bid and contract documents.
- D. An "Acceptable Substitution" requested after the award of bid will only be approved if proven to the satisfaction of the Owner and the Designer 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 and all requests of this nature must be submitted in accordance with Article 3.1 of the General Conditions.

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 on the bid documents or the bid will be rejected for being non-responsive.
- B. Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals. Bidders must verify each specific project's requirements in Section 004113 to ensure they have provided all the required documentation with their submission.

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
004545	Anti-Discrimination Against Israel Act Certification form

- C. The Bidder shall submit its bid on the forms provided by the Owner in the same file format (PDF) with each space fully and properly completed, typewritten or legibly printed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner will reject bids that are not on the Owner's forms and that do not contain all requested information. All forms can be found on the Owner's website at <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans> and shall be submitted to FMDCBids@oa.mo.gov.
- D. All bids shall be submitted without additional terms and conditions, modifications, or reservations. The completed forms shall not include interlineations, alterations, or erasures. Bids not in compliance with the requirements of this paragraph will be rejected as non-responsive.
- E. 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 in the bid documents in Section 004113. Failure of the Bidder to submit the duly authorized bid bond or 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 bid closing or if the Bidder, within ten (10) working days after notification of award, refuses or is unable to 1) execute the tendered contract, 2) provide an acceptable performance and payment bond, or 3) provide evidence of required insurance coverage.
- F. The bid bond 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.

6.0 - SIGNING OF BIDS

- A. A bid shall contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form shall appear as shown in the Secretary of State's records. If the Bidder is an entity organized in a state other than Missouri, the Bidder must provide a Certificate of Authority to do business in the State of Missouri.
- B. If the successful Bidder is doing business in the State of Missouri under a fictitious name, the Bidder 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.
- C. A bid from an individual shall be signed as noted on the Bid Form.
- D. A bid from a partnership or joint venture shall require only one signature of a partner, an officer of the joint venture authorized to bind the venture, or an attorney-in-fact. If the bid is signed by an officer of

a joint venture or an attorney-in-fact, a document evidencing the individual's authority to execute contracts should be included with the bid form.

- E. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.
- F. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual and the corporate license number shall be provided. In addition, for corporate proposals, the President or Vice-President listed per the current filing with the Missouri Secretary of State should sign as the Bidder. If the signatory is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signatory has the legal authority to bind the corporation.

7.0 - RECEIVING BID SUBMITTALS

- A. It is the Bidder's sole responsibility to ensure receipt of the bid submittals by Owner on or before the date and time specified in the Invitation for Bid or as modified via written addenda. Bids received after the date and time specified will not be considered by the Owner.
- B. All bids shall be received via email at FMDCBids@oa.mo.gov. A bid submitted through any other means, including hard copies, will not be considered and will be discarded by the Owner unopened.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

- A. Bidder may withdraw a bid at any time prior to the 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. Bidder may modify a bid until the scheduled closing time by sending a revised bid to FMDCBids@oa.mo.gov with a note in the subject line and body of the email that it is a revised bid. A revised bid sent via any other method will not be considered.

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 limited to, contracts for the furnishing and installation of furniture, equipment, machinery, appliances and other apparatuses.
- C. The Owner will award a contract to the lowest, responsive, and responsible Bidder in accordance with Section 8.250, RSMo. No contract will be awarded to any Bidder who has had a contract with the Owner terminated within the preceding twelve months for material breach of contract or who has been suspended or debarred by the Owner.
- 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 lowest, responsive, responsible bidder.
- E. No award shall be considered binding upon the Owner until the written contract has been properly executed and the following documentation has been provided: 1) performance and payment bond consistent with Article 6.1 of the General Conditions; 2) proof of the required insurance coverage; 3) an executed Section 004541 - Affidavit of Work Authorization form; and 4) documentation evidence enrollment and participation in a federal work authorization program.
- F. Failure to execute and return the contract and associated documents within the prescribed period 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.
- G. 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.

- H. 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. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding E-Verify is located at <https://www.e-verify.gov/employers/enrolling-in-e-verify>. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.
- I. The successful Bidder must be registered in MissouriBUYS powered by MOVERS at <https://missouribuyss.mo.gov/supplier-registration#> as an approved vendor prior to being issued a contract.

10.0 - CONTRACT SECURITY

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

11.0 - WORKING DAYS

- A. Contract duration time is stated in working days and will use the following definition in determining the actual calendar date for contract completion:
 - 1. Working days are defined as all calendar days except Saturdays, Sundays and the following State of Missouri observed holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday, Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day.

12.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

- A. By signing the bid form and submitting a bid on this project, the Bidder certifies that it will use American and Missouri products as set forth in Article 1.7 of the General Conditions. Bidders are advised to review those requirements carefully prior to bidding.
- B. A preference shall be given to Missouri firms, corporations or individuals, or firms, corporations or individuals that maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less.
- C. Pursuant to Section 34.076, RSMo, a contractor or Bidder domiciled outside the boundaries of the State of Missouri shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor or Bidder domiciled in Missouri as would be required for such a Missouri domiciled contractor or Bidder to succeed over the bidding contractor or Bidder domiciled outside Missouri on a like contract or bid being let in the Bidder's domiciliary state and, further, the contractor or Bidder domiciled outside the boundaries of Missouri shall be required to submit an audited financial statement as would be required of a Missouri domiciled contractor or Bidder on a like contract or bid being let in the domiciliary state of that contractor or Bidder.

13.0 – ANTI-DISCRIMINATION AGAINST ISRAEL ACT CERTIFICATION:

- A. If the Bidder meets the section 34.600, RSMo., definition of a “company” and the Bidder has ten or more employees, the Bidder must certify in writing that the Bidder is not currently engaged in a boycott of goods or services from the State of Israel and shall not engage in a boycott of goods or services from the State of Israel, if awarded a contract, for the duration of the contract. The Bidder is required to complete and submit the applicable portion of Section 004545 - Anti-Discrimination Against Israel Act Certification with its Bid Form. The applicable portion of the exhibit must be submitted prior to execution of a contract by the Owner and issuance of Notice to Proceed.

14.0 - MBE/WBE/SDVE INSTRUCTIONS

- A. Definitions:
 - 1. “MBE” means a Minority Business Enterprise.
 - 2. “MINORITY” has the same meaning as set forth in 1 C.S.R. 10-17.010.

3. **“MINORITY BUSINESS ENTERPRISE”** has the same meaning as set forth in section 37.020, RSMo.
4. **“WBE”** means a Women’s Business Enterprise.
5. **“WOMEN’S BUSINESS ENTERPRISE”** has the same meaning as set forth in section 37.020, RSMo.
6. **“SDVE”** means a Service-Disabled Veterans Enterprise.
7. **“SERVICE-DISABLED VETERAN”** has the same meaning as set forth in section 34.074, RSMo.
8. **“SERVICE-DISABLED VETERAN ENTERPRISE”** has the same meaning as “Service-Disabled Veteran Business” set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

1. For all bids greater than \$100,000, the Bidder shall obtain MBE, WBE and SDVE participation in an amount equal to or greater than the percentage goals set forth in the Invitation for Bid and the Bid Form, unless the Bidder is granted a Good Faith Effort waiver by the Director of the Division, as set forth below. If the Bidder does not meet the MBE, WBE and SDVE goals, or make a good faith effort to do so, the Bidder shall be nonresponsive, and its bid shall be rejected.
2. The Bidder should submit with its bid all the information requested in the MBE/WBE/SDVE Compliance Evaluation Form for every MBE, WBE, or SDVE subcontractor or material supplier the Bidder intends to use for the contract work. The Bidder is required to submit all MBE/WBE/SDVE documentation before the stated time and date set forth in the Invitation for Bid. If the Bidder fails to provide such information by the specified date and time, the Owner shall reject the bid.
3. The Director reserves the right to request additional information from a Bidder to clarify the Bidder’s proposed MBE, WBE, and/or SDVE participation. The Bidder shall submit the clarifying information requested by the Owner within two (2) working days of receiving the request for clarification.
4. Pursuant to section 34.074, RSMo, a Prime Bidder that qualifies as an SDVE shall receive a three-percentage point bonus preference in the contract award evaluation process. The bonus preference will be calculated and applied by reducing the bid amount of the eligible SDVE by three percent of the apparent low responsive Bidder’s bid. Based on this calculation, if the eligible SDVE’s evaluation is less than the apparent low responsive Bidder’s bid, the eligible SDVE’s bid will become the apparent low responsive bid. This reduction is for evaluation purposes only and will have no impact on the actual amount(s) of the bid or the amount(s) of any contract awarded. In order to be eligible for the SDVE preference, the Bidder must complete and submit with its bid the Missouri Service-Disabled Veteran Business Form, and any information required by the form.

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

1. A Bidder who is a MBE, WBE, or SDVE may count 100% of the contract towards the MBE, WBE or SDVE goal, less any amounts awarded to another MBE, WBE or SDVE. (NOTE: a MBE firm that bids as general contractor must obtain WBE and SDVE participation; a WBE firm that bids as a general contractor must obtain MBE and SDVE participation; and a SDVE firm that bids as general contractor must obtain MBE and WBE participation.) For the remaining contract amount to be counted towards the MBE, WBE or SDVE goal, the Bidder must complete the MBE/WBE/SDVE Compliance Evaluation Form (Section 004337) identifying itself as an MBE, WBE or SDVE.
2. The total dollar value of the work granted to a certified MBE, WBE or SDVE by the Bidder shall be counted towards the applicable goal.
3. Expenditures for materials and supplies obtained from a certified MBE, WBE, or SDVE supplier or manufacturer may be counted towards the MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.

4. The total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier may be counted towards a Bidder's MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE properly assumes the actual and contractual responsibility for the work.
5. The total dollar value of work granted to a certified joint venture equal to the percentage of the ownership and control of the MBE, WBE, or SDVE partner in the joint venture may be counted towards the MBE/WBE/SDVE goals.
6. Only expenditures to a MBE, WBE, or SDVE that performs a commercially useful function in the work may be counted towards the MBE, WBE and SDVE goals. A MBE, WBE, or SDVE performs a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by performing, managing and supervising the work or providing supplies or manufactured materials.

D. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Equal Opportunity or by the Federal U.S. Small Business Administration directory.
2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)'s online MBE/WBE directory <https://apps1.mo.gov/MWBCertifiedFirms/>. The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Office of Equal Opportunity online SDVE directory at <https://o eo.mo.gov/sdve-certification-program/> or the Federal U.S. Small Business Administration directory <https://veterans.certify.sba.gov/#search>.
3. Additional information, clarifications, or other information regarding the MBE/WBE/SDVE listings in the directories may be obtained by contacting the Contract Specialist of record as shown in the Supplementary Conditions (Section 007300).

E. Waiver of MBE/WBE/SDVE Participation:

1. If a Bidder has made a good faith effort to secure the required MBE, WBE and/or SDVE participation and has failed, the Bidder shall submit with its bid the information requested in MBE/WBE/SDVE Good Faith Effort (GFE) Determination form. The Director will determine if the Bidder made a good faith effort to meet the applicable goals. If the Director determines that the Bidder did not make a good faith effort, the bid shall be rejected as being nonresponsive to the bid requirements. Bidders who demonstrate that they have made a good faith effort to include MBE, WBE, and/or SDVE participation will be granted a waiver and will be considered to be responsive to the applicable participation goals, regardless of the percent of actual participation obtained, if the bid is otherwise acceptable.
2. In determining whether a Bidder has made a good faith effort to obtain MBE, WBE and/or SDVE participation, the Director may evaluate the factors set forth in 1 CSR 30-5.010(6)(C) and the following:
 - a. The amount of actual participation obtained;
 - b. How and when the Bidder contacted potential MBE, WBE, and SDVE subcontractors and suppliers;
 - c. The documentation provided by the Bidder to support its contacts, including whether the Bidder provided the names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;
 - d. If project information, including plans and specifications, were provided to MBE/WBE/SDVE subcontractors;
 - e. Whether the Bidder made any attempts to follow-up with MBE, WBE or SDVE firms prior to bid;

- f. Amount of bids received from any of the subcontractors and/or suppliers that the Bidder contacted;
- g. The Bidder's stated reasons for rejecting any bids;

F. Contractor MBE/WBE/SDVE Obligations

1. If awarded a contract, the Bidder will be contractually required to subcontract with or obtain materials from the MBE, WBE, and SDVE firms listed in its bid, in amounts equal to or greater than the dollar amount in the bid, unless the amount is modified in writing by the Owner.
2. If the Contractor fails to meet or maintain the participation requirements contained in the Contractor's bid, the Contractor must satisfactorily explain to the Director why it cannot comply with the requirement and why failing meeting the requirement was beyond the Contractor's control. If the Director finds the Contractor's explanation unsatisfactory, the Director may take any appropriate action including, but not limited to:
 - a. Declaring the Contractor ineligible to participate in any contracts with the Division for up to twelve (12) months (suspension); and/or
 - b. Declaring the Contractor be nonresponsive to the Invitation for Bid, or in breach of contract and rejecting the bid or terminating the contract.
3. If the Contractor replaces an MBE, WBE, or SDVE during the course of the contract, the Contractor shall replace it with another MBE, WBE, or SDVE or make a good faith effort to do so. All MBE, WBE and SDVE substitutions must be approved by the Director in writing.
4. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. At a minimum, the Contractor shall report the dollar-value of work completed by each MBE, WBE, or SDVE during the preceding month and the cumulative total of work completed by each MBE, WBE or SDVE to date with each monthly application for payment. The Contractor shall also make a final report, which shall include the total dollar-value of work completed by each MBE, WBE, and SDVE during the entire contract.



State of Missouri Construction Contract

THIS AGREEMENT is 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.

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: USB Roof Replacement and Latrine Renovation
Chillicothe Readiness Center
Chillicothe, Missouri

Project Number: T2519-01

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

ARTICLE 2. TIME OF COMPLETION

The contract performance time is **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 \$1,000** per day for each and every day, Sunday and legal holidays excepted, during which the work remains incomplete and unfinished. Any sum which may be due the Owner for such damages shall be deducted and retained by the Owner from any balance which may be due the Contractor when said work shall have been finished and accepted. But such provisions shall not release the Bond of the Contractor from liability according to its terms. In case of failure to complete, the Owner will be under no obligation to show or prove any actual or specific loss or damage.

ARTICLE 4. CONTRACT SUM

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

Base Bid: \$

Accepted Alternates, if applicable to the Project and accepted by the Owner.

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.

ARTICLE 5. PREVAILING WAGE RATE

MISSOURI PREVAILING WAGE LAW (Sections 290.210 to 290.340, RSMo): The Contractor shall pay not less than the specified hourly rate of wages, as set out in the wage order attached to and made part of the specifications for work under this contract, to all workers performing work under the contract, in accordance with sections 290.210 to 290.340, RSMo. The Contractor shall forfeit a penalty to the Owner of one hundred dollars per day (or portion of a day) for each worker that is paid less than the specified rates for any work done under the contract by the Contractor or by any subcontractor, in accordance with section 290.250, RSMo.

DAVIS-BACON ACT: If this Project is financed in whole or in part from Federal funds (as indicated in the Instructions to Bidders or other bid or contract documents for this Project), then this contract shall be subject to all applicable federal labor statutes, rules and regulations, including provisions of the Davis-Bacon Act, 40 U.S.C. §3141 et seq., and the "Federal Labor Standards Provisions," as further set forth in Section 007333 – Supplementary General Conditions for Federally Funded/Assisted Construction Projects, which is incorporated into the contract by reference. Where the Missouri Prevailing Wage Law and the Davis-Bacon Act require payment of different wages for work performed under this contract, the Contractor and all Subcontractors shall pay the greater of the wages required under either law, on a classification-by-classification basis.

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

The Contractor has been granted a waiver of the 0% MBE and 0% 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

The following documents are hereby incorporated into this contract by reference (all division/section numbers and titles are as utilized in the Project Manual published by the Owner for this Project):

1. Division 0 – Procurement and Contracting Information, including, but not limited to:
 - a. Invitation for Bid (Section 001116)
 - b. Instructions to Bidders (Section 002113)
 - c. Supplementary Instructions to Bidders (if applicable) (Section 002213)
 - d. The following documents as completed and executed by the Contractor and accepted by the Owner, if applicable:
 - i. Bid Form (Section 004113)
 - ii. Unit Prices (Section 004322)
 - iii. Proposed Contractors Form (Section 004336)
 - iv. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)
 - v. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)
 - vi. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
 - vii. Missouri Service Disabled Veteran Business Form (Section 004340)
 - viii. Affidavit of Work Authorization (Section 004541)
 - e. Performance and Payment Bond, completed and executed by the Contractor and surety (Section 006113)
 - f. General Conditions (Section 007213)
 - g. Supplementary Conditions (Section 007300)
 - h. Supplementary General Conditions for Federally Funded/Assisted Construction Projects (Section 007333), if applicable
 - i. Wage Rate(s) (Section 007346)
2. Division 1 – General Requirements
3. All Drawings identified in the Project Manual
4. All Technical Specifications included in the Project Manual
5. Addenda, if applicable

ARTICLE 8 – CERTIFICATION

By signing this contract, the Contractor hereby re-certifies compliance with all legal requirements set forth in Section 6.0, Bidder's Certifications of the Bid Form.

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

APPROVED:

Crystal Wessing, Interim Director
Division of Facilities Management,
Design and Construction

Contractor's Authorized Signature

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

SECTION 006113 - PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS, THAT we _____

as principal, and _____

_____ as Surety, are held and firmly bound unto the

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

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

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

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

(Insert Project Title and Number)

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

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

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

AS APPLICABLE:

AN INDIVIDUAL

Name: _____

Signature: _____

A PARTNERSHIP

Name of Partner: _____

Signature of Partner: _____

Name of Partner: _____

Signature of Partner: _____

CORPORATION

Firm Name: _____

Signature of President: _____

SURETY

Surety Name: _____

Attorney-in-Fact: _____

Address of Attorney-in-Fact: _____

Telephone Number of Attorney-in-Fact: _____

Signature Attorney-in-Fact: _____

NOTE: Surety shall attach Power of Attorney



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

PROJECT NUMBER

PROJECT TITLE AND LOCATION

CHECK APPROPRIATE BOX

- ☐ **SUBSTITUTION PRIOR TO BID OPENING**
(Minimum of (5) working days prior to receipt of Bids as per Article 4 – Instructions to Bidders)
- ☐ **SUBSTITUTION FOLLOWING AWARD**
(Maximum of (20) working days from Notice to Proceed as per Article 3 – General Conditions)

FROM: BIDDER/CONTRACTOR (PRINT COMPANY NAME)

TO: ARCHITECT/ENGINEER (PRINT COMPANY NAME)

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

SPECIFIED PRODUCT OR SYSTEM

SPECIFICATION SECTION NO.

SUPPORTING DATA

- ☐ Product data for proposed substitution is attached (include description of product, standards, performance, and test data)
- ☐ Sample ☐ Sample will be sent, if requested

QUALITY COMPARISON

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

PREVIOUS INSTALLATIONS

PROJECT	ARCHITECT/ENGINEER
LOCATION	DATE INSTALLED

SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT

REASON FOR SUBSTITUTION	
DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?	
☐ YES ☐ NO	
IF YES, EXPLAIN	
SUBSTITUTION REQUIRES DIMENSIONAL REVISION OR REDESIGN OF STRUCTURE OR A/E WORK	
☐ YES ☐ NO	
BIDDER'S/CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:	
We have investigated the proposed substitution. We believe that it is equal or superior in all respects to specified product, except as stated above; that it will provide the same Warranty as specified product; that we have included complete implications of the substitution; that we will pay redesign and other costs caused by the substitution which subsequently become apparent; and that we will pay costs to modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning as a result of the substitution.	
BIDDER/CONTRACTOR	DATE
REVIEW AND ACTION	
☐ Resubmit Substitution Request with the following additional information:	
☐ Substitution is accepted.	
☐ Substitution is accepted with the following comments:	
☐ Substitution is not accepted.	
ARCHITECT/ENGINEER	DATE



STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
FINAL RECEIPT OF PAYMENT AND RELEASE

PROJECT NUMBER

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

(PROJECT TITLE, PROJECT LOCATION, AND PROJECT NUMBER)

at

(ADDRESS OF PROJECT)

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

DOES HEREBY:

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

DATED this day of , 20 .

NAME OF SUBCONTRACTOR

BY (TYPED OR PRINTED NAME)

SIGNATURE

TITLE

ORIGINAL: FILE/Closeout Documents



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

MBE/WBE/SDVE PROGRESS REPORT

Remit with **ALL** Progress and Final Payments

(Please check appropriate box) ☐CONSULTANT ☐CONSTRUCTION

PAY APP NO.	PROJECT NUMBER
CHECK IF FINAL ☐ FINAL	DATE

PROJECT TITLE			
PROJECT LOCATION			
FIRM			
ORIGINAL CONTRACT SUM (Same as Line Item 1. on Form A of Application for Payment) \$		TOTAL CONTRACT SUM TO DATE (Same as Line Item 3. on Form A of Application for Payment) \$	
THE TOTAL MBE/WBE/SDVE PARTICIPATION DOLLAR AMOUNT OF THIS PROJECT AS INDICATED IN THE ORIGINAL CONTRACT: \$			
SELECT MBE, WBE, SDVE	ORIGINAL CONTRACT PARTICIPATION AMOUNT	PARTICIPATION AMOUNT PAID-TO-DATE (includes approved contract changes)	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER COMPANY NAME
☐ MBE ☐ WBE ☐ SDVE	\$	\$	
☐ MBE ☐ WBE ☐ SDVE	\$	\$	
☐ MBE ☐ WBE ☐ SDVE	\$	\$	
☐ MBE ☐ WBE ☐ SDVE	\$	\$	
☐ MBE ☐ WBE ☐ SDVE	\$	\$	
☐ MBE ☐ WBE ☐ SDVE	\$	\$	

Revised 06/2023

INSTRUCTIONS FOR MBE/WBE/SDVE PROGRESS REPORT

CONTRACTOR OR CONSULTANT TO FILL OUT AND REMIT WITH EACH PAY APPLICATION:

The MBE/WBE/SDVE Progress Report for the project is issued with the contract comprising values reported in the consultant's Proposal or on the successful contractor's Section 004337 Compliance Evaluation Forms.

At Initial Pay Application fill in the following:

1. Pay App No. Start with 1.
2. Fill in the Project Number and Date.
3. Enter Project Title, Project Location, and Firm.
4. Fill in the "Original Contract Sum" and "Total Contract Sum To Date" (Reference applicable Line Items on Form A of Application for Payment).
5. Indicate the Total Participation Dollar Amount from the Original Contract.
6. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier.
7. Enter the "Total Amount of Subcontract", "\$ Amount (Paid-To-Date)", and Company Name.

For all subsequent Pay Applications fill in the following:

1. Pay App No.
2. If Final Pay App, check box.
3. Fill in the Project Number and Date.
4. Enter Project Title, Project Location, and Firm
5. At each Pay App fill in the "Original Contract Sum" and "Total Contract Sum To Date" (reference applicable Line Items on Form A of Application for Payment).
6. Indicate the Total Participation Dollar Amount from the Original Contract.
7. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier
8. Enter the "Total Amount of Subcontract", "\$ Amount (Paid-To-Date)", and Company Name.



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

PROJECT NUMBER

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

State of _____ personally came and appeared _____

(NAME)

of the _____

(POSITION)

(NAME OF THE COMPANY)

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

(NAME OF PROJECT)

Located at _____ in _____ County

(NAME OF THE INSTITUTION)

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

SIGNATURE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSEY OR
BLACK INK RUBBER STAMP SEAL

STATE

COUNTY (OR CITY OF ST. LOUIS)

SUBSCRIBED AND SWORN BEFORE ME, THIS

DAY OF

YEAR

USE RUBBER STAMP IN CLEAR AREA BELOW

NOTARY PUBLIC SIGNATURE

MY COMMISSION
EXPIRES

NOTARY PUBLIC NAME (TYPED OR PRINTED)

FILE: Closeout Documents

GENERAL CONDITIONS

INDEX

ARTICLE:

1. General Provisions

- 1.1. Definitions
- 1.2. Drawings and Specifications
- 1.3. Compliance with Laws, Permits, Regulations and Inspections
- 1.4. Nondiscrimination in Employment
- 1.5. Anti-Kickback
- 1.6. Patents and Royalties
- 1.7. Preference for American and Missouri Products and Services
- 1.8. Communications
- 1.9. Separate Contracts and Cooperation
- 1.10. Assignment of Contract
- 1.11. Indemnification
- 1.12. Disputes and Disagreements

2. Owner/Designer Responsibilities

3. Contractor Responsibilities

- 3.1. Acceptable Substitutions
- 3.2. Submittals
- 3.3. As-Built Drawings
- 3.4. Guaranty and Warranties
- 3.5. Operation and Maintenance Manuals
- 3.6. Other Contractor Responsibilities
- 3.7. Subcontracts

4. Changes in the Work

- 4.1. Changes in the Work
- 4.2. Changes in Completion Time

5. Construction and Completion

- 5.1. Construction Commencement
- 5.2. Project Construction
- 5.3. Project Completion
- 5.4. Payments

6. Bond and Insurance

6.1. Bond

6.2. Insurance

7. Termination or Suspension of Contract

7.1. For Site Conditions

7.2. For Cause

7.3. For Convenience

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

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

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

ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

- A. In case of discrepancy between drawings and specifications, specifications shall govern. Should discrepancies in architectural drawings, structural drawings and mechanical drawings occur, architectural drawings shall govern and, in case of conflict between structural and mechanical drawings, structural drawings shall govern.
- B. Specifications are separated into titled divisions for convenience of reference only and to facilitate letting of contracts and subcontracts. The Contractor is responsible for establishing the scope of work for subcontractors, which may cross titled divisions. Neither the Owner nor Designer will establish limits and jurisdiction of subcontracts.
- C. Figured dimensions take precedence over scaled measurements and details over smaller scale general drawings. In the event of conflict between any of the documents contained within the contract, the documents shall take precedence and be controlling in the following sequence: addenda, supplementary general conditions, general conditions, division 1 specifications, technical division specifications, drawings, bid form and instructions to bidders.
- D. Anything shown on drawings and not mentioned in these specifications or vice versa, as well as any incidental work which is obviously necessary to complete the project within the limits established by the drawings and specifications, although not shown on or described therein, shall be performed by the Contractor at no additional cost as a part of his contract.
- E. Upon encountering conditions differing materially from those indicated in the contract documents, the Contractor shall promptly notify the Designer and Construction Representative in writing before such conditions are disturbed. The Designer shall promptly investigate said conditions and report to the Owner, with a recommended course of action. If conditions do materially differ and cause an increase or decrease in contract cost or time required for completion of any portion of the work, a contract change will be initiated as outlined in Article 4 of these General Conditions.
- E. Only work included in the contract documents is authorized, and the Contractor shall do no work other than that described therein or in accordance with appropriately authorized and approved contract changes.

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

- A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on 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 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 under this clause to any labor union with which they have bargaining or other agreements.

B. 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

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

ARTICLE 1.6 - PATENTS AND ROYALTIES

- A. The Contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liabilities of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.
- B. If the Contractor uses any design, device or materials covered by letters, patent or copyright, the Contractor shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, without exception, that the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES

- A. By virtue of statutory authority a preference will be given to Missouri labor and to products of mines, forests and quarries of the state of Missouri when they are found in marketable quantities in the state, and all such materials shall be of the best quality and suitable character that can be obtained at reasonable market prices, all as provided for in Section 8.280, Missouri Revised Statutes and Cumulative Supplements.
- B. Furthermore, pursuant to Section 34.076 Missouri Revised Statutes and Cumulative Supplements, a preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be required for a Missouri bidder to successfully bid in the non-domiciliary state.
- C. In accordance with the Missouri Domestic Products Procurement Act Section 34.350 RSMo and Cumulative Supplements any manufactured goods or commodities used or supplied in the performance of this contract or any subcontract thereto shall be manufactured, assembled or produced in the United States, unless the specified products are not manufactured, assembled or produced in the United States in sufficient quantities to meet the agency's requirements or cannot be manufactured, assembled or produced in the United States within the necessary time in sufficient quantities to meet the contract requirements, or if obtaining the specified products manufactured, assembled or produced in the United States would increase the cost of this contract for purchase of the product by more than ten percent.

ARTICLE 1.8 - COMMUNICATIONS

- A. All notices, requests, instructions, approvals, and claims must be in writing and shall be delivered to the Designer and copied to the Construction Representative for the project except as required by Article 1.12 Disputes and Disagreements, or as otherwise specified by the Owner in writing as stated in Section 012600. Any such notice shall be deemed to have been given as of the time of actual receipt.
- B. The Contractor shall attend on-site progress and coordination meetings, as scheduled by the Construction Representative, no less than once a month.

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

ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION

- A. The Owner reserves the right to let other contracts in connection with this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.
- B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner's Representative before the work is performed. If the Contractor fails to do this, and constructs any work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner's Representative at no additional cost to the Owner.
- C. Each contractor shall be required to coordinate his work with other contractors so as to afford others reasonable opportunity for execution of their work. No contractor shall delay any other contractor by neglecting to perform contract work at the proper time. If any contractor causes delay to another, they shall be liable directly to that contractor for such delay in addition to any liquidated damages which might be due the Owner.
- D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.
- E. Each Contractor shall be responsible for damage done to Owner's or other Contractor's property by him/her or workers in his employ through their fault or negligence.
- F. Should a Contractor sustain any damage through any act or omission of any other Contractor having a contract with the Owner, the Contractor so damaged shall have no claim or cause of action against the Owner for such damage, but shall have a claim or cause of action against the other Contractor to recover any and all damages sustained by reason of the acts or omissions of such Contractor. The phrase "acts or omissions" as used in this section shall be defined to include, but

not be limited to, any unreasonable delay on the part of any such contractors.

ARTICLE 1.10 - ASSIGNMENT OF CONTRACT

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

ARTICLE 1.11 - INDEMNIFICATION

- A. Contractor agrees to indemnify and save harmless Owner and its respective commissioners, officers, officials, agents, consultants and employees and Designer, their agents, servants and employees, from and against any and all liability for damage arising from injuries to persons or damage to property occasioned by any acts or omissions of Contractor, any subcontractors, agents, servants or employees, including any and all expense, legal or otherwise, which may be incurred by Owner or Designer, its agents, servants or employees, in defense of any claim, action or suit.
- B. The obligations of the Contractor under this paragraph shall not extend to the liability of the Designer, his agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, contract changes, design or specifications, or (2) giving of or the failure to give directions or instructions by the Designer, his agents or employees as required by this contract documents provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 1.12 - DISPUTES AND DISAGREEMENTS

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

The Contractor shall register and utilize the Owner's eBuilder digital project management system for submission of documents described in the following sections. This includes but is not limited to submittals as required by designer, payment applications, Request for Information (RFI), construction change orders, Request for Proposals (RFP), Designer Supplemental Instructions (DSI), etc.

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 plate 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 ensure 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 subject to the following limits: (a) the percentage mark-up for the Contractor shall be limited to the Contractor's fee; (b) fifteen percent (15%) maximum for Work directly performed by employees of a subcontractor, or sub-subcontractor; (c) five percent (5%) maximum for the Work performed or passed through to the Owner by the Contractor; (d) five percent (5%) maximum subcontractor's mark-up for

Work performed by a sub-subcontractor and passed through to the Owner by the subcontractor and Contractor; and (e) in no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty-five percent (25%) of the cost of materials, labor and equipment (exclusive of Contractor or any Subcontractor overhead and profit) necessary to put the contract change work in place.

3. The Contractor will be allowed to add the cost of Contractor's payment and performance bonding, builder's risk insurance, and general liability insurance to their cost of work. The above listed bonding and insurance cost shall not exceed two percent (2%) and shall be allowed on the total cost of the added work, including overhead and profit.
 4. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work.
 5. The percentage(s) for overhead and profit to be credited to the Owner on Contract Changes that are solely decreases in the quantity of work or materials shall be the same as those for additive Contract Changes provided above.
- E. No claim for an addition to this contract sum shall be valid unless authorized as aforesaid in writing by the Owner. In the event that none of the foregoing methods are agreed upon, the Owner may order the Contractor to perform work on a time and material basis. The cost of such work shall be determined by the Contractor's actual labor and material cost to perform the work plus overhead and profit as outlined herein. The Designer and Construction Representative shall approve the Contractor's daily time and material invoices for the work involved.
- F. If the Contractor claims that any instructions involve extra cost under this contract, the Contractor shall give the Owner's Representative written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute the work. No such claim shall be valid unless so made and authorized by the Owner, in writing.
- G. In an emergency affecting the safety of life or of the structure or of adjoining property, the Contractor, without special instruction or authorization from the Construction Representative, is hereby permitted to act at their discretion to prevent such threatened loss or injury. The Contractor shall submit a claim for compensation for such emergency work in writing to the Owner's Representative.

ARTICLE 4.2 – CHANGES IN COMPLETION TIME

- A. Extension of the number of work days stipulated in the Contract for completion of the work with compensation may be made when:
1. The contractor documents that proposed Changes in the work, as provided in Article 4.1, extends construction activities critical to contract completion date, OR
 2. The Owner suspends all work for convenience of the Owner as provided in Article 7.3, OR
 3. An Owner caused delay extends construction activities critical to contract completion (except as provided elsewhere in these General Conditions). The Contractor is to review the work activities yet to begin and evaluate the possibility of rescheduling the work to minimize the overall project delay.
- B. Extension of the number of work days stipulated in the Contract for completion of the work 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 ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.

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

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

ARTICLE 5.2 -- PROJECT CONSTRUCTION

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

with the requirements outlined in Section 013200 – Schedules.

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

ARTICLE 5.3 -- PROJECT COMPLETION

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

1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
 - a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
 - b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
 - c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working days notice before the inspection shall be performed.
2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of

Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.

3. If the work is not acceptable, and the Owner does not issue a Certificate of Substantial Completion, the Owner shall be entitled to charge the Contractor with the Designer's and Owner's costs of re-inspection, including time and travel.
- B. Partial Occupancy. Contractor agrees that the Owner shall be permitted to occupy and use any completed or partially completed portions of the Project, when such occupancy and use is in the Owner's best interest. Owner shall notify Contractor of its desire and intention to take Partial Occupancy as soon as possible but at least ten (10) working days before the Owner intends to occupy. If the Contractor believes that the portion of the work the Owner intends to occupy is not ready for occupancy, the Contractor shall notify the Owner immediately. The Designer shall inspect the work in accordance with the procedures above. If the Contractor claims increased cost of the project or delay in completion as a result of the occupancy, he shall notify the Owner immediately but in all cases before occupancy occurs.
- C. Final Completion. The Project is finally complete when the Certificate of Substantial Completion has been issued and all work items identified therein as incomplete have been completed, and when all administrative items required by the contract have been completed. Final Completion entitles the Contractor to payment of the outstanding balance of the contract amount including all change orders and retainage. Within five (5) working days of the date of the Certificate of Substantial Completion, the Contractor shall identify the cost to complete any outstanding items of work. The Designer shall review the Contractor's estimate and either approve it or provide an independent estimate for all such items. If the Contractor fails to complete the remaining items within the time specified in the Certificate, the Owner may terminate the contract and go to the surety for project completion in accordance with Article 7.2 or release the contract balance to the Contractor less 150% of the approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A

DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

- D. Liquidated Damages. Contractor agrees that the Owner may deduct from the contract price and retain as liquidated damages, and not as penalty or forfeiture, the sum stipulated in this contract for each work day after the Contract Completion Day on which work is not Substantially Complete. Assessment of Liquidated Damages shall not relieve the Contractor or the surety of any responsibility or obligation under the Contract. In addition, the Owner may, without prejudice to any other rights, claims, or remedies the Owner may have including the right to Liquidated Damages, charge the Contractor for all additional expenses incurred by the Owner and/or Designer as the result of the extended contract period through Final Completion. Additional Expenses shall include but not be limited to the costs of additional inspections.
- E. Early Completion. The Contractor has the right to finish the work before the contract completion date; however, the Owner assumes no liability for any hindrances to the Contractor unless Owner caused delays result in a time extension to the contract completion date. The Contractor shall not be entitled to any claims for lost efficiencies or for delay if a Certificate of Substantial Completion is given on or before the Contract Completion Date.

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

- A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make payment within 30 calendar days after the "Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:
 1. Updated construction schedule
 2. Certified payrolls consisting of name, home addresses of all workers, occupation and craft, number of hours worked and actual wages paid for each individual employee, of the Contractor and all subcontractors working on the project

- B. The Owner shall retain 5 percent of the amount of each such payment application, except as allowed by Article 5.4, until final completion and acceptance of all work covered by this contract.
- C. Each payment made to Contractor shall be on account of the total amount payable to Contractor and all material and work covered by paid partial payment shall thereupon become the sole property of Owner. This provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work or as a waiver of the right of Owner to require fulfillment of all terms of this contract.
- D. Materials delivered to the work site and not incorporated in the work will be allowed in the Application and Certification for Payment on the basis of one hundred (100%) percent of value, subject to the 5% retainage providing that they are suitably stored on the site or in an approved warehouse in accordance with the following requirements:
 - 1. Material has previously been approved through submittal and acceptance of shop drawings conforming to requirements of Article 3.2 of General Conditions.
 - 2. Delivery is made in accordance with the time frame on the approved schedule.
 - 3. Materials, equipment, etc., are properly stored and protected from damage and deterioration and remain so - if not, previously approved amounts will be deleted from subsequent pay applications.
 - 4. The payment request is accompanied by a breakdown identifying the material equipment, etc. in sufficient detail to establish quantity and value.
- E. The Contractor shall be allowed to include in the Application and Certification for Payment, one hundred (100%) of the value, subject to retainage, of major equipment and material stored off the site if all of the following conditions are met:
 - 1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.
 - 2. Materials stored in one location off site are valued in excess of \$25,000.
 - 3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft

conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.

- 4. The materials are stored in a facility approved and inspected, by the Construction Representative.
- 5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.
- F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.
- G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:
 - 1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or items. The cost of corrective action(s) shall be borne by the Contractor.
 - 2. A reasonable doubt that this contract can be completed for the unpaid balance.
 - 3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.
 - 4. Failure of the Contractor to update the construction schedule.

When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.
- H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be

directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.

1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.
2. The final payment shall not become due until the Contractor delivers to the Construction Representative:
 - a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from the Surety to final payment accepting liability for any unpaid amounts.
 - b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor
 - c) Certified copies of all payrolls
 - d) As-built drawings
3. If any claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a claim including all costs and a reasonable attorney's fee.
4. Missouri statute requires prompt payment from the Owner to the Contractor within thirty calendar days and from the Contractor to his subcontractors within fifteen calendar days. Failure to make payments within the required

time frame entitles the receiving party to charge interest at the rate of one and one half percent per month calculated from the expiration of the statutory time period until paid.

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

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

- A. Contractor shall furnish a performance/payment bond in an amount equal to 100% of the contract price to guarantee faithful performance of the contract and 100% of the contract price to guarantee the payment of all persons performing labor on the project and furnishing materials in connection therewith under this contract as set forth in the standard form of performance and payment bond included in the contract documents. The surety on such bond shall be issued by a surety company authorized by the Missouri Department of Insurance to do business in the state of Missouri.
- B. All Performance/Payment Bonds furnished in response to this provision shall be provided by a bonding company with a rating of B+ or higher as established by A.M. Best Company, Inc. in their most recent publication.

ARTICLE 6.2 – INSURANCE

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

B. Minimum Scope and Extent of Coverage

1. General Liability

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

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

2. Automobile Liability

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

3. Workers' Compensation and Employer's Liability

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

4. Builder's Risk or Installation Floater Insurance

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

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

C. Minimum Limits of Insurance

1. General Liability

Contractor

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

\$2,000,000	annual aggregate

2. Automobile Liability

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

3. Workers' Compensation and Employers Liability

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

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

D. Deductibles and Self-Insured Retentions

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

payment of losses and related investigations, claims administration, and defense expenses.

E. Other Insurance Provisions and Requirements

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

1. General Liability

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

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

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

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

2. Automobile Insurance

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

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance or self-insurance

programs maintained by the designated additional insured's shall be in excess of the Contractor's insurance and shall not contribute with it.

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

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

3. Workers' Compensation/Employer's Liability

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

4. All Coverages

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

F. Insurer Qualifications and Acceptability

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

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor's applicable insurance coverage expires prior to completion of the work or services required under this contract -

the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

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:

Project Manager: Nathan Graessle
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, MO 65101
Telephone: 573-508-6646
Email: nathaniel.graessle@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 5 complete sets of drawings and specifications at no charge.
- B. The Owner will furnish the Contractor with approximately 5 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 SAFETY REQUIREMENTS

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

6.0 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.

SECTION 007333 – NATIONAL GUARD - SUPPLEMENTARY GENERAL CONDITIONS
FOR FEDERALLY FUNDED/ASSISTED CONSTRUCTION PROJECTS

1.0 Notice of Federal Funding

This project is being performed in whole or in part using federal funds. Therefore, all work or services performed by the Contractor and its subcontractors shall be subject to the terms and conditions set forth below in addition to all terms and conditions in the Construction Contract, General Conditions, and other contract documents. The concepts, rules, and guidelines set forth in 2 C.F.R. 200 describing allowable costs and administrative requirements apply.

2.0 Definitions

As used herein, “Federal Government” means the government of the United States of America. “Federal Agency” means an agency, entity, department or division of the Federal Government that is providing funding for this project. All other terms shall have the meanings established in the Construction Contract, General Conditions, and/or Project Manual, unless such definitions conflict with a definition provided in an applicable statute or regulation.

3.0 Conflicting Terms or Conditions

To the extent that any terms or conditions set forth herein conflict with the Construction Contract or its General Conditions, the more stringent of the two terms and conditions shall govern.

4.0 No Obligation by Federal Government

The Federal Government is not a party to this contract and is not subject to any obligations or liabilities to the non-Federal entity, Contractor, or any other party pertaining to any matter resulting from the contract.

5.0 Compliance with Federal Laws, Regulations and Executive Orders

The Contractor and its subcontractors and suppliers are required to comply with all applicable Federal laws, regulations, and executive orders, regardless of whether set forth herein. The Contractor shall assist and enable the State of Missouri in complying with any requirements imposed by the Federal Agency as a condition of funding.

6.0 Compliance with Civil Rights Provisions

The Contractor shall comply with all Federal statutes, executive orders, and regulations relating to nondiscrimination. These include, but are not limited to the following:

Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin;

Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex;

Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps;

The Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age;

Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing;

Title VII of the Civil Rights Act of 1964 (42 U.S.C. part 2000(e), which prohibits discrimination against employees on the basis of religion;

Any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and

The requirements of any other nondiscrimination statute(s) that may apply to the application.

7.0 Equal Employment Opportunity (41 C.F.R. 60-1.4(b)).

During the performance of this contract, the Contractor agrees as follows:

- (1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:

Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

- (2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
- (3) The Contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicants or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the Contractor's legal duty to furnish information.
- (4) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor

union or workers' representatives of the Contractor's commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (4) in every subcontract or purchase order. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: *Provided*, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: *Provided*, That if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and sub-contractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

8.0 Prohibition of Segregated Facilities

- (1) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Employment Opportunity clause in this contract.
- (2) "Segregated facilities," as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.
- (3) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Employment Opportunity clause of this contract.

9.0 Copeland "Anti-Kickback" Act

- (1) The Contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract. The Contractor and subcontractors are prohibited from inducing, by any means, any person employed on the project to give up any part of the compensation to which the employee is entitled.

- (2) The Contractor or subcontractor shall insert in any subcontracts the clause above, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.
- (3) A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 C.F.R. 5.12.

10.0 Contract Work Hours and Safety Standards Act (40 U.S.C. 3701 to 3708, 29 C.F.R. 5.5)

- (1) Overtime requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of \$27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.
- (3) Withholding for unpaid wages and liquidated damages. The Owner shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.
- (4) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section.

11.0 Suspension and Debarment (Executive Orders 12549 and 12689, 2 C.F.R. pt. 180)

- (1) A contract award (see 2 C.F.R. 180.220) must not be made to parties listed on the government-wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. 180 that implement Executive Orders 12549 (3 C.F.R. pt. 1986 Comp., p. 189) and 12689 (3

C.F.R. pt. 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

- (2) The contractor is required to verify that none of the contractor’s principals (defined at 2 C.F.R. 180.995) or its affiliates (defined at 2 C.F.R. 180.905) are excluded (defined at 2 C.F.R. 180.940) or disqualified (defined at 2 C.F.R. 180.935).
- (3) The contractor must comply with 2 C.F.R. pt. 180, subpart C and the regulations of the granting Federal Agency regarding suspension and debarment and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.
- (4) This certification is a material representation of fact relied upon by the Owner. If it is later determined that the Contractor did not comply with 2 C.F.R. pt. 180, subpart C in addition to remedies available to the Owner, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.
- (5) By submitting a bid, the bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

12.0 Byrd Anti-Lobbying Amendment (31 U.S.C. § 1352)

- (1) Contractors that apply or bid for an award exceeding \$100,000 agree to file the required certification (set forth below), in compliance with 31 U.S.C. § 1352 (as amended).
- (2) Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352.
- (3) Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient who in turn will forward the certification(s) to the awarding agency.

CERTIFICATION REGARDING LOBBYING

The Bidder or Offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

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

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

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

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

13.0 Procurement of Recovered Materials

The Contractor shall comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (42 U.S.C. § 6962). The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

Information about this requirement, along with the list of EPA designated items, is available at EPA’s Comprehensive Procurement Guidelines web site, <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>.

14.0 Fair Labor Standards Act

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 C.F.R. pt. 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part-time workers. The Contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

15.0 Access to Records and Reports

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the Owner, the Federal Agency and the Comptroller General of the United States or any of their duly authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

16.0 Occupational Health and Safety Act

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 C.F.R. pt. 1910 with the same force and effect as if given in full text. The employer must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The employer retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (20 C.F.R. pt. 1910). The employer must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

17.0 Rights to Inventions

Contracts or agreements that include the performance of experimental, developmental, or research work must provide for the rights of the Federal Government and the Owner in any resulting invention as established by 37 C.F.R. pt. 401, Rights to Inventions Made by Non-profit Organizations and Small Business Firms under Government Grants, Contracts, and Cooperative Agreements. This contract incorporates by reference the patent and inventions rights as specified within 37 C.F.R. 401.14. Contractor must include this requirement in all sub-tier contracts involving experimental, developmental, or research work.

18.0 Energy Conservation

The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. § 6201 et seq.).

19.0 Clean Air Act and Federal Water Pollution Control Act

- (1) If the amount of the Contract exceeds \$150,000, the Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq. and the Federal Water Pollution Control Act, as amended, 33 U.S.C. § 1251 et seq.
- (2) The Contractor agrees to report each violation to the Owner, and understands and agrees that the Owner will, in turn, report each violation as required to assure notification to the Federal Agency and the appropriate Environmental Protection Agency Regional Office.
- (3) The Contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance.

20.0 Contractor Employee Whistleblower Rights and Requirement to Inform Employees of Whistleblower Rights

- (1) This contract and employees working on this contract will be subject to the whistleblower rights and remedies in the pilot program on contractor employee whistleblower protections established at 41 U.S.C. § 4712 by section 828 of the National Defense Authorization Act for Fiscal Year 2013 (Pub. L. 112-239) and FAR 3.908.

- (2) The Contractor shall inform its employees in writing, in the predominant language of the workforce, of employee whistleblower rights and protections under 41 U.S.C. § 4712, as described in section 3.908 of the Federal Acquisition Regulation.
- (3) The Contractor shall insert the substance of this clause, including this paragraph (c), in all subcontracts over the simplified acquisition threshold.

21.0 Veteran's Preference

In the employment of labor (excluding executive, administrative, and supervisory positions), the Contractor and all sub-tier contractors must give preference to covered veterans as defined within Title 49 United States Code Section 47112. Covered veterans include Vietnam-era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns (as defined by 15 U.S.C. § 632) owned and controlled by disabled veterans. This preference only applies when there are covered veterans readily available and qualified to perform the work to which the employment relates.

22.0 Drug Free Workplace Act

The Contractor shall provide a drug free workplace in accordance with the Drug Free Workplace Act of 1988, 41 U.S.C. Chapter 81, and all applicable regulations. The Contractor shall report any conviction of the Contractor's personnel under a criminal drug statute for violations occurring on the Contractor's premises or off the Contractor's premises while conducting official business. A report of a conviction shall be made to the state agency within five (5) working days after the conviction.

23.0 Access Requirements for Persons with Disabilities

Contractor shall comply with 49 U.S.C. § 5301(d), stating Federal policy that the elderly and persons with disabilities have the same rights as other persons to use mass transportation services and facilities and that special efforts shall be made in planning and designing those services and facilities to implement that policy. Contractor shall also comply with all applicable requirements of Sec. 504 of the Rehabilitation Act (1973), as amended, 29 U.S.C. § 794, which prohibits discrimination on the basis of handicaps, and the Americans with Disabilities Act of 1990 (ADA), as amended, 42 U.S.C. § 12101 et seq., which requires that accessible facilities and services be made available to persons with disabilities, including any subsequent amendments thereto.

24.0 Seismic Safety

The Contractor agrees to ensure that all work performed under this contract, including work performed by subcontractors, conforms to a building code standard that provides a level of seismic safety substantially equivalent to standards established by the National Earthquake Hazards Reduction Guidelines for Contract Provisions for Obligated Sponsors and Airport Improvement Program Projects Issued on June 19, 2018 Page 61 Program (NEHRP). Local building codes that model their code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety.

25.0 Required Use of American Iron, Steel, Manufactured Products, and Construction Materials – Build America, Buy America (Pub. L. No. 117-58, §§ 70901-52)

The Owner is the recipient of an award of Federal financial assistance from a program for infrastructure for this project. Pursuant to the Build America, Buy America Act of the Infrastructure Investment and Jobs Act

(“IIJA”), Pub. L. No. 117-58, none of the funds provided under the Federal award may be used unless the requirements of the domestic content procurement preference outlined below are met. Therefore, the Contractor shall ensure the following:

- (1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;
- (2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 65 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and
- (3) all construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States.

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.

Waivers

When necessary, recipients of Federal financial assistance may apply for, and the awarding agency may grant, a waiver from the domestic content procurement preference.

When the Federal agency has made a determination that one of the following exceptions applies, the awarding official may waive the application of the domestic content procurement preference in any case in which the agency determines that:

- (1) applying the domestic content procurement preference would be inconsistent with the public interest;
- (2) the types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
- (3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent. A request to waive the application of the domestic content procurement preference must be in writing. The agency will provide instructions on the format, contents, and supporting materials required for any waiver request. Waiver requests are subject to public comment periods of no less than 15 days and must be reviewed by the Made in America Office.

There may be instances where an award qualifies, in whole or in part, for an existing waiver described on the awarding agency web site.

If the Contractor determines that an application for a waiver is necessary or an existing waiver is applicable to this project, the Contractor shall timely notify the Owner. The Owner will make a determination if a waiver is applicable or if a waiver application is necessary. The Contractor shall not submit any waiver application or information directly to the Federal agency without prior approval by the Owner.

Definitions

“Construction materials” includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives—that is or consists primarily of: • non-ferrous metals; • plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); • glass (including optic glass); • lumber; or • drywall.

“Domestic content procurement preference” means all iron and steel used in the project are produced in the United States; the manufactured products used in the project are produced in the United States; or the construction materials used in the project are produced in the United States.

“Infrastructure” includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

“Project” means the construction, alteration, maintenance, or repair of infrastructure in the United States.

26.0 Prohibition on Certain Telecommunication and Video Surveillances Services or Equipment (Pub. L. 115-232, Section 889)

Section 889(b) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115-232, and 2 C.F.R. § 200.216 prohibit the head of a Federal executive agency and recipients or subrecipients of funds from such agencies from obligating or expending grant, cooperative agreement, loan, or loan guarantee funds on certain telecommunications products or from certain entities for national security reasons. Pursuant to such provisions, the Contractor understands and agrees that the Contractor and its subcontractors shall not obligate or expend loan or grant funds from the Federal Agency under this Contract to:

- (1) Procure or obtain;
- (2) Extend or renew a contract to procure or obtain; or
- (3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in [Public Law 115–232](#), section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

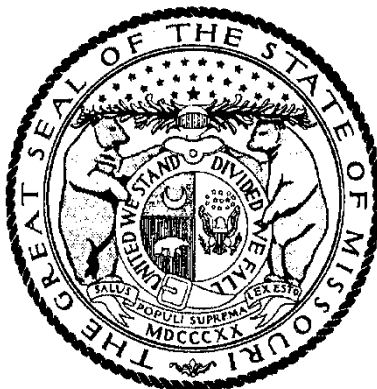
(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.

(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MIKE KEHOE, Governor

Annual Wage Order No. 33

Section 059 LIVINGSTON 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 _____

Logan Hobbs, Director
Division of Labor Standards

Filed With Secretary of State: _____ **March 10, 2026**

Last Date Objections May Be Filed: **April 9, 2026**

Prepared by Missouri Department of Labor and Industrial Relations

LIVINGSTON COUNTY

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$26.42*
Boilermaker	\$26.42*
Bricklayer - Stone Mason	\$26.42*
Carpenter	\$66.46
Lather	
Linoleum Layers & Cutter	
Millwright	
Pile Driver	
Cement Mason	\$26.42*
Plasterer	
Communication Technician	\$26.42*
Electrician (Inside Wireman)	\$80.73
Electrician (Outside Lineman)	\$26.42*
Outside - Groundman	
Outside - Groundman Tree Trimmer	
Outside - Lineman Operator	
Outside - Lineman Tree Trimmer	
Elevator Constructor	\$26.42*
Glazier	\$26.42*
Iron Worker	\$70.54
Laborer	\$26.42*
Laborer - First Semi-Skilled	
Laborer - General	
Laborer - Second Semi-Skilled	
Laborer - Skilled	
Mason	\$26.42*
Marble Finisher	
Marble Mason	
Terrazzo Finisher	
Terrazzo Worker	
Tile Finisher	
Tile Setter	
Operating Engineer	\$66.22
Operating Engineer - Group I	
Operating Engineer - Group II	
Operating Engineer - Group III	
Operating Engineer - Group III - A	
Operating Engineer - Group IV	
Operating Engineer - Group V	
Painter	\$26.42*
Plumber	\$26.42*
Pipe Fitter	
Roofer/WaterProofer	\$26.42*
Sheet Metal Worker	\$26.42*
Sprinkler Fitter - Fire Protection	\$26.42*
Truck Driver	\$26.42*
Truck Control Service Driver	
Truck Driver, Teamsters Group I	
Truck Driver, Teamsters Group II	
Truck Driver, Teamsters Group III	
Truck Driver, Teamsters Group IV	

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

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMo Section 290.210.

LIVINGSTON COUNTY

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$66.71
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$26.42*
Outside - Groundman	
Outside - Groundman Tree Trimmer	
Outside - Lineman Operator	
Outside - Lineman Tree Trimmer	
Laborer	\$49.99
Laborer - General	
Laborer - Skilled	
Operating Engineer	\$26.42*
Operating Engineer - Group I	
Operating Engineer - Group II	
Operating Engineer - Group III	
Operating Engineer - Group IV	
Truck Driver	\$26.42*
Truck Control Service Driver	
Truck Driver, Teamsters Group I	
Truck Driver, Teamsters Group II	
Truck Driver, Teamsters Group III	
Truck Driver, Teamsters Group IV	

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

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

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

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

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

OVERTIME and HOLIDAYS

OVERTIME

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

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

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

HOLIDAYS

January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

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

SECTION 011000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of renovating and converting an existing break room into a new women's restroom / locker room with additional showers, toilets and new interior finishes. In addition, the existing roof of the Unheated Storage Building (USB) is to receive a roof re-covering as well as new sheet metal gutters and downspouts.
 - 1. Project Location: Chillicothe Readiness Center
1500 Washington St., Chillicothe, MO 64601
 - 2. Owner: State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S Truman State Office Building, Post Office Box 809, 301 West High Street, Jefferson City, Missouri 65102.
- B. Contract Documents, dated **July 31, 2026** were prepared for the Project by Clark & Enersen, 2020 Baltimore Ave, Suite 300, Kansas City, MO 64108. Contact: Rick Wise, 816-474-8237.
- C. The Work consists of renovating a break room into new women's locker room and roof replacement of USB Building.
 - 1. The Work includes new interior finishes, MEP systems, new roofing, and site work.
- D. The Work will be constructed under a single prime contract.

1.3 WORK SEQUENCE

- A. The Work will be conducted in one phase.
 - 1. Phase one: Interior renovations, roof replacement, and site work. Work of this phase shall be substantially complete, ready for occupancy within six months of commencement of construction.

1.4 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.
- B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Owner Occupancy: Allow for Owner occupancy and use by the public.
 - 2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

- C. Use of the Existing Building: Maintain the existing building in a weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period..

1.5 OCCUPANCY REQUIREMENTS

- 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. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
 - 1. The Designer will prepare a Certificate of Partial Occupancy for each specific portion of the Work to be occupied prior to substantial completion.
 - 2. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will operate and maintain mechanical and electrical systems serving occupied portions for the building.
 - 3. Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions for the building.

1.6 OWNER-FURNISHED PRODUCTS

- A. The Owner will furnish restroom accessories as noted in the Drawings. The Work includes providing support systems to receive Owner's equipment, and mechanical and electrical connections.
 - 1. The Owner will arrange for and deliver necessary shop drawings, product data, and samples to the Contractor.
 - 2. The Owner will arrange and pay for delivery of Owner-furnished items according to the contractor's Construction Schedule.
 - 3. The Contractor is responsible for receiving, unloading and handling Owner furnished items at the site.
 - 4. Following delivery, the Contractor will inspect items delivered for damage. The Contractor shall not accept damaged items and shall notify the Owner of rejection of damaged items.
 - 5. If Owner-furnished items are damaged, defective, or missing, the Owner will arrange for replacement.
 - 6. The Owner will arrange for manufacturer's field services and for the delivery of manufacturer's warranties to the appropriate Contractor.
 - 7. The Contractor shall designate delivery dates of Owner-furnished items in the Contractor's Construction Schedule.
 - 8. The Contractor shall review shop drawings, product data and samples and return them to the Designer noting discrepancies or problems anticipated in use of the project.
 - 9. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements. The Contractor shall repair or replace items damaged as a result of his operations.

1.7 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF PRODUCTS ORDERED IN ADVANCE

END OF SECTION 01 10 00

SECTION 01 21 00 – ALLOWANCES

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 Change Order.
- 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 Change Orders 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 daily 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 Change Order time extension will be executed for "bad weather" days, as defined above, encountered during the remainder of the Project.

1.4 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, Designer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Designer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Designer from the designated supplier.

1.5 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

PART 2 - PRODUCTS (Not Used)

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 eight (8) "bad weather" days.

END OF SECTION 01 21 00

SECTION 01 26 00 – 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 1, Section 013115 "Project Management Communications" for administrative requirements for communications.
 - 3. Division 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
 - 4. Division 0, Section 007213, Article 4.0 "Changes in the Work" for Change Order 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 ten (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 five (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 ten (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 Change Order for the work. Failure to give such written notice within ten (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 Amount or the Contract Time. The proposed Change Description will be issued using the "Request for Proposal" (RFP) form. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by the Designer or Owner Representative are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within ten (10) working days after receipt of Proposal Request, submit a proposal for the cost adjustments to the Contract Amount and the Contract Time necessary to execute the Change. The Contractor shall submit his proposal on the appropriate Change Order Detailed Breakdown form. Subcontractors may use the appropriate Change Order Detailed Breakdown form or submit their proposal on their letterhead provided the same level of detail is included. All proposals shall include:
 - a. A detailed breakdown of costs per Article 4.1 of the General Conditions.
 - b. If requesting additional time per Article 4.2 of the General Conditions, include an updated Contractor's Construction Schedule that indicates the effect of the Change including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, the Designer or Owner Representative will issue a Change Order for signatures of Owner and Contractor on the "Change Order" form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 31 00 – COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Projects including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
- B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific Contractor.
- C. Related Sections include the following:
 - 1. Division 1, Section 013200 "Schedule – Bar Chart" for preparing and submitting Contractor's Construction Schedule.
 - 2. Articles 1.8.B and 1.8.C of Section 007213 "General Conditions" for coordinating meetings onsite.
 - 3. Article 5.4.H of Section 007213 "General Conditions" for coordinating Closeout of the Contract.

1.3 COORDINATION

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

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

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
- B. Key Personnel Names: Within fifteen (15) work days of starting construction operations, submit a list of key personnel assignments including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 PROJECT MEETINGS

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

- B. Progress Meetings: The Owner's Construction Representative will conduct Monthly Progress Meetings as stated in Articles 1.8.B and 1.8.C of Section 007213 "General Conditions".
1. Minutes: Designer will record and distribute to Contractor the meeting minutes.
- C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of Manufacturers and Fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Designer and Construction Representative of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration including requirements for the following:
 - a. Contract Documents
 - b. Options
 - c. Related RFIs
 - d. Related Change Orders
 - e. Purchases
 - f. Deliveries
 - g. Submittals
 - h. Review of mockups
 - i. Possible conflicts
 - j. Compatibility problems
 - k. Time schedules
 - l. Weather limitations
 - m. Manufacturer's written recommendations
 - n. Warranty requirements
 - o. Compatibility of materials
 - p. Acceptability of substrates
 - q. Temporary facilities and controls
 - r. Space and access limitations
 - s. Regulations of authorities having jurisdiction
 - t. Testing and inspecting requirements
 - u. Installation procedures
 - v. Coordination with other Work
 - w. Required performance results
 - x. Protection of adjacent Work
 - y. Protection of construction and personnel
 3. Contractor shall record significant conference discussions, agreements, and disagreements including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
6. Revise paragraph below if Project requires holding progress meetings at different intervals. Insert special intervals such as "every third Tuesday" to suit special circumstances.
7. Project name
8. Name and address of Contractor
9. Name and address of Designer
10. RFI number including RFIs that were dropped and not submitted
11. RFI description
12. Date the RFI was submitted
13. Date Designer's response was received
14. Identification of related DSI or Proposal Request, as appropriate

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 31 15 - PROJECT MANAGEMENT COMMUNICATIONS

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.
- B. Division 1, Section 013300 - Submittals
- C. Division 1, Section 012600 – Contract Modification Procedures

1.2 SUMMARY

- A. Project Management Communications: The Contractor shall use the Internet web-based project management communications tool, Trimble Unity Construct® (Formerly eBuilder) ASP software, and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
 - 1. Project management communications is available through Trimble Unity Construct® (Formerly eBuilder) as provided by "Trimble Unity Construct®" in the form and manner required by the Owner.
 - 2. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited
- B. Support: Trimble Unity Construct® (Formerly eBuilder) will provide on-going support through on-line help files.
- C. Copyrights and Ownership: Nothing in this specification or the subsequent communications supersedes the parties' obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD/BIM files, processes or design information distributed in this system is intended only for the project specified herein.
- D. Purpose: The intent of using Trimble Unity Construct®(Formerly eBuilder) is to improve project work efforts by promoting timely initial communications and responses. Secondly, to reduce the number of paper documents while providing improved record keeping by creation of electronic document files
- E. Authorized Users: Access to the web site will be by individuals who are authorized users.
 - 1. Individuals shall complete the Trimble Unity Construct (Formerly eBuilder) New Company/User Request Form located at the following web site: <https://oa.mo.gov/facilities/vendor-links/contractor-forms>. Completed forms shall be emailed to the following email address: OA.FMDCE-BuilderSupport@oa.mo.gov.
 - 2. Authorized users will be contacted directly and assigned a temporary user password.
 - 3. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.
- F. Administrative Users: Administrative users have access and control of user licenses and all posted items. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE

DATABASE! Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s).

- G. Communications: The use of fax, email and courier communication for this project is discouraged in favor of using Trimble Unity Construct® (Formerly eBuilder) to send messages. Communication functions are as follows:

1. Document Integrity and Revisions:
 - a. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
 - b. The system shall make it easy to identify revised or superseded documents and their predecessors.
 - c. Server or Client-side software enhancements during the life of the project shall not alter or restrict the content of data published by the system. System upgrades shall not affect access to older documents or software.
2. Document Security:
 - a. The system shall provide a method for communication of documents. Documents shall allow security group assignment to respect the contractual parties communication except for Administrative Users. **DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE!**
3. Document Integration:
 - a. Documents of various types shall be logically related to one another and discoverable. For example, requests for information, daily field reports, supplemental sketches and photographs shall be capable of reference as related records.
4. Reporting:
 - a. The system shall be capable of generating reports for work in progress, and logs for each document type. Summary reports generated by the system shall be available for team members.
5. Notifications and Distribution:
 - a. Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.
6. Required Document Types:
 - a. RFI, Request for Information.
 - b. Submittals, including record numbering by drawing and specification section.
 - c. Transmittals, including record of documents and materials delivered in hard copy.
 - d. Meeting Minutes.
 - e. Application for Payments (Draft or Pencil).
 - f. Review Comments.
 - g. Field Reports.
 - h. Construction Photographs.
 - i. Drawings.
 - j. Supplemental Sketches.
 - k. Schedules.
 - l. Specifications.
 - m. Request for Proposals
 - n. Designer's Supplemental Instructions
 - o. Punch Lists

- H. Record Keeping: Except for paper documents, which require original signatures and large format documents (greater than 8½ x 11 inches), all other 8½ x 11 inches documents shall be submitted by transmission in electronic form to the Trimble Unity Construct® (Formerly eBuilder) web site by licensed users.
- a. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Subcontractors and suppliers at every tier shall respond to documents received in electronic form on the web site and consider them as if received in paper document form.
 - b. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Subcontractors and suppliers at every tier reserves the right to and shall reply or respond by transmissions in electronic form on the web site to documents actually received in paper document form.
 - c. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Subcontractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.
- I. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Owner and his representatives, the Construction Manager and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier required to have a user license(s) shall be responsible for the following:
1. Providing suitable computer systems for each licensed user at the users normal work location¹ with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
 2. Each of the above referenced computer systems shall have the following minimum system² and software requirements:
 - a. Desktop configuration (Laptop configurations are similar and should be equal to or exceed desktop system.)
 - 1) Operating System: Windows XP or newer
 - 2) Internet Browser: Internet Explorer 6.01SP2+ (Recommend IE7.0+)
 - 3) Minimum Recommend Connection Speed: 256K or above
 - 4) Processor Speed: 1 Gigahertz and above
 - 5) RAM: 512 mb
 - 6) Operating system and software shall be properly licensed.
 - 7) Internet Explorer version 7 (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
 - 8) Adobe Acrobat Reader (current version is a free distribution for download).
 - 9) Users should have the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable.)

END OF SECTION 013115

¹ The normal work location is the place where the user is assigned for more than one-half of his time working on this project.

² The minimum system herein will not be sufficient for many tasks and may not be able to process all documents and files stored in the Trimble Unity Construct® (Formerly eBuilder) Documents area.

SECTION 01 32 00 – SCHEDULE – BAR CHART

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 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 including Schedule of Values showing the rate of progress the Contractor agrees to maintain and the order in which he proposed to carry out the various phases of Work. No payments shall be made to the Contractor until the Progress Schedule has been approved by the Owner.
 - 1. The Schedule of Values must have the following line items included with the value of the item as indicated below:
 - a. O&M's (Owner's Manual)
 - 1) \$1,000,000.00 (One million) and under – 2% of the total contract amount
 - 2) Over \$1,000,000.00 (One million) – 1% of the total contract amount
 - b. Close Out Documents
 - 1) \$1,000,000.00 (One million) and under – 2% of the total contract amount
 - 2) Over \$1,000,000.00 (One million) – 1% of the total contract amount
 - c. General Conditions
 - 1) No more than 10%
- B. The Contractor shall submit an updated Schedule for presentation at each Monthly Progress Meeting. The Schedule shall be updated by the Contractor as necessary to reflect the current Schedule and its relationship to the original Schedule. The updated Schedule shall reflect any changes in the logic, sequence, durations, or completion date. Payments to the Contractor shall be suspended if the Progress Schedule is not adequately updated to reflect actual conditions.
- C. The Contractor shall submit Progress Schedules to Subcontractors to permit coordinating their Progress Schedules to the general construction Work. The Contractor shall

coordinate preparation and processing of Schedules and reports with performance of other construction activities.

3.2 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

- A. Bar-Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor's Construction Schedule. The Contractor for general construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of "bad" weather days specified in Section 012100 – Allowances.
1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.
 - a. If practical, use the same Schedule of Values breakdown for schedule time bars.
 2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar 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
 10. Provisions for future construction

11. Seasonal variations
 12. Environmental control
- C. Work Stages: Use crosshatched bars to indicate important stages of construction for each major portion of the Work. Such stages include, but are not necessarily limited to, the following:
1. Subcontract awards
 2. Submittals
 3. Purchases
 4. Mockups
 5. Fabrication
 6. Sample testing
 7. Deliveries
 8. Installation
 9. Testing
 10. Adjusting
 11. Curing
 12. Startup and placement into final use and operation
- D. Area Separations: Provide a separate time bar to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a “major area” is a story of construction, a separate building, or a similar significant construction element.
1. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Permanent space enclosure
 - c. Completion of mechanical installation
 - d. Completion of the electrical portion of the Work
 - e. Substantial Completion

3.3 SCHEDULE OF SUBMITTALS

- A. Upon acceptance of the Construction Progress Schedule, prepare and submit a complete schedule of submittals. Coordinate the submittal schedule with Section 013300 SUBMITTALS, the approved Construction Progress Schedule, list of subcontracts, Schedule of Values and the list of products.
- B. Prepare the schedule in chronological order. Provide the following information
1. Scheduled date for the first submittal
 2. Related Section number
 3. Submittal category
 4. Name of the Subcontractor
 5. Description of the part of the Work covered
 6. Scheduled date for resubmittal
 7. Scheduled date for the Designer's final release or approval

- C. Distribution: Following the Designer's response to the initial submittal schedule, print and distribute copies to the Designer, Owner, subcontractors, and other parties required to comply with submittal dates indicated.
 - 1. Post copies in the Project meeting room and temporary field office.
 - 2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in construction activities.
- D. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

3.4 SCHEDULE OF INSPECTIONS AND TESTS

- A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule with (15) days of the date established for commencement of the Contract Work. The Contractor 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 01 32 00

SECTION 01 33 00 – SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.
- B. Division 1, Section 013115 “Project Management Communications” for administrative requirements for communications.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work including the following:
 - 1. Shop Drawings
 - 2. Product Data
 - 3. Samples
 - 4. Quality Assurance Submittals
 - 5. Construction Photographs
 - 6. Operating and Maintenance Manuals
 - 7. Warranties
- B. Administrative Submittals: Refer to General and Supplementary Conditions other applicable Division 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. Notifications, Permits, etc.
- C. The Contractor is obliged and responsible to check all shop drawings and schedules to assure compliance with contract plans and specifications. The Contractor is responsible for the content of the shop drawings and coordination with other contract work. Shop drawings and schedules shall indicate, in detail, all parts of an Item or Work including erection and setting instructions and integration with the Work of other trades.
- D. The Contractor shall at all times make a copy, of all approved submittals, available on site to the Construction Representative.

1.3 SUBMITTAL PROCEDURES

- A. The Contractor shall comply with the General and Supplementary Conditions and other applicable sections of the Contract Documents. The Contractor shall submit, with such promptness as to cause no delay in his work or in that of any other contractors, all required submittals indicated in Part 3.1 of this section and elsewhere in the Contract Documents. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
- B. Each drawing and/or series of drawings submitted must be accompanied by a letter of transmittal giving a list of the titles and numbers of the drawings. Each series shall be numbered consecutively for ready reference and each drawing shall be marked with the following information:
 - 1. Date of Submission
 - 2. Name of Project
 - 3. Location
 - 4. Section Number of Specification
 - 5. State Project Number
 - 6. Name of Submitting Contractor
 - 7. Name of Subcontractor
 - 8. Indicate if Item is submitted as specified or as a substitution

1.4 SHOP DRAWINGS

- A. Comply with the General Conditions, Article 3.2.
- B. The Contractor shall submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- C. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings including the following information:
 - 1. Dimensions
 - 2. Identification of products and materials included by sheet and detail number
 - 3. Compliance with specified standards
 - 4. Notation of coordination requirements
 - 5. Notation of dimensions established by field measurement
 - 6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8½"x11" but no larger than 36"x48".

1.5 PRODUCT DATA

- A. The Contractor shall comply with the General Conditions, Article 3.2.
- B. The Contractor shall collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information including the following information:
 - a. Manufacturer's printed recommendations
 - b. Compliance with Trade Association standards
 - c. Compliance with recognized Testing Agency standards
 - d. Application of Testing Agency labels and seals
 - e. Notation of dimensions verified by field measurement
 - f. Notation of coordination requirements
 - 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.6 SAMPLES

- A. The Contractor shall comply with the General Conditions, Article 3.2.
- B. The Contractor shall submit full-size, fully fabricated samples, cured and finished as specified, and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
 - 1. The Contractor shall mount or display samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Designer's sample including the following:
 - a. Specification Section number and reference
 - b. Generic description of the Sample
 - c. Sample source
 - d. Product name or name of the Manufacturer
 - e. Compliance with recognized standards
 - f. Availability and delivery time
 - 2. The Contractor shall submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (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 onsite 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.

1.7 QUALITY ASSURANCE DOCUMENTS

- A. The Contractor shall comply with the General Conditions, Article 3.2
- B. The Contractor shall submit quality control submittals including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- C. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the Manufacturer certifying compliance with specified requirements.
 - 1. Signature: Certification shall be signed by an officer of the Manufacturer or other individual authorized to contractually bind the Company.
- D. Inspection and Test Reports: The Contractor shall submit the required inspection and test reports from independent testing agencies as specified in this Section and in other Sections of the Contract Documents.
- E. Construction Photographs: The Contractor shall submit record construction photographs as specified in this Section and in other Sections of the Contract Documents.
 - 1. The Contractor shall submit digital photographs. The Construction Administrator shall determine the quantity and naming convention at the preconstruction meeting.
 - 2. The Contractor shall identify each photograph with project name, location, number, date, time, and orientation.
 - 3. The Contractor shall submit progress photographs monthly unless specified otherwise. Photographs shall be taken one (1) week prior to submitting.
 - 4. The Contractor shall take four (4) site photographs from differing directions and a minimum of five (5) interior photographs indicating the relative progress of the Work.

1.8 OPERATING AND MAINTENANCE MANUALS AND WARRANTIES

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

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

SPEC SECTION	TITLE	CATEGORY
01 32 00	Schedules	Construction Schedule
01 32 00	Schedules	Schedule of Values
01 32 00	Schedules	List of Subcontractors
01 32 00	Schedules	Major Material Suppliers
02 41 19	Selective Demolition	Construction Schedule
03 30 01	Cast-In-Place Concrete – Site Work	Product Data
03 30 01	Cast-In-Place Concrete – Site Work	Shop Drawings
03 30 01	Cast-In-Place Concrete – Site Work	Certification
06 10 00	Rough Carpentry	Product Data
06 10 00	Rough Carpentry	Test Report
07 42 00	Metal Window Panels	Product Data
07 42 00	Metal Window Panels	Shop Drawings
07 53 23	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	Product Data
07 53 23	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	Sample
07 53 23	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	Shop Drawings
07 53 23	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	Certification
07 62 00	Sheet Metal Flashing and Trim	Product Data
07 62 00	Sheet Metal Flashing and Trim	Shop Drawings
07 72 53	Snow Guards	Product Data
07 72 53	Snow Guards	Shop Drawings
07 92 00	Joint Sealants	Product Data
07 92 00	Joint Sealants	Sample
07 92 00	Joint Sealants	Test Report
08 11 13	Joint Sealants	Warranty
08 11 13	Hollow Metal Doors and Frames	Product Data
08 11 13	Hollow Metal Doors and Frames	Shop Drawings
08 11 13	Hollow Metal Doors and Frames	Test Report
08 14 16	Flush Wood Door	Product Data
08 14 16	Flush Wood Door	Shop Drawings
08 14 16	Flush Wood Door	Test Report
08 71 00	Door Hardware	Product Data
08 71 00	Door Hardware	Test Report
08 83 00	Door Hardware	Warranty
08 83 00	Mirrors	Product Data

08 83 00	Mirrors	Sample
08 83 00	Mirrors	Test Report
08 83 00	Mirrors	Warranty
08 87 10	Window Film	Product Data
08 87 10	Window Film	Sample
08 87 10	Window Film	Warranty
09 22 16	Non-Structural Metal Framing	Product Data
09 29 00	Gypsum Board	Product Data
09 51 13	Acoustical Panel Ceilings	Product Data
09 51 13	Acoustical Panel Ceilings	Sample
09 51 13	Acoustical Panel Ceilings	Shop Drawings
09 51 13	Acoustical Panel Ceilings	Test Report
09 51 13	Acoustical Panel Ceilings	Operation / Maintenance Manual
09 65 19	Resilient Base and Accessories	Product Data
09 65 19	Resilient Base and Accessories	Sample
09 65 19	Resilient Base and Accessories	Test Report
09 65 19	Resilient Base and Accessories	Shop Drawings
09 65 19	Resilient Base and Accessories	Operation / Maintenance Manual
09 67 13	Broadcast-Applied Decorative Flake Resinous Flooring	Product Data
09 67 13	Broadcast-Applied Decorative Flake Resinous Flooring	Sample
09 67 13	Broadcast-Applied Decorative Flake Resinous Flooring	Certification
09 67 13	Broadcast-Applied Decorative Flake Resinous Flooring	Test Report
09 67 13	Broadcast-Applied Decorative Flake Resinous Flooring	Operation / Maintenance Manual
09 67 13	Broadcast-Applied Decorative Flake Resinous Flooring	Warranty
09 91 23	Interior Painting	Product Data
09 91 23	Interior Painting	Sample
09 96 13	Fiber-Reinforced Abrasive Coatings	Product Data
09 96 13	Fiber-Reinforced Abrasive Coatings	Sample
10 21 19	Plastic Toilet Compartments	Product Data
10 21 19	Plastic Toilet Compartments	Shop Drawings
10 21 19	Plastic Toilet Compartments	Sample
10 21 19	Plastic Toilet Compartments	Operation / Maintenance Manual
10 26 00	Wall Protection	Product Data
10 26 00	Wall Protection	Shop Drawings
10 28 00	Toilet and Bath Accessories	Product Data
10 28 00	Toilet and Bath Accessories	Warranty
10 28 00	Toilet and Bath Accessories	Operation / Maintenance Manual
22 05 00	Basic Plumbing Requirements	Product Data
22 05 00	Basic Plumbing Requirements	Shop Drawings
22 05 00	Basic Plumbing Requirements	Certification
22 05 00	Basic Plumbing Requirements	Warranty
22 05 00	Basic Plumbing Requirements	Operation / Maintenance Manual
22 05 13	Electrical Requirements for Plumbing Equipment	Product Data

22 05 13	Electrical Requirements for Plumbing Equipment	Operation / Maintenance Manual
22 05 19	Plumbing Meters and Gauges	Product Data
22 05 19	Plumbing Meters and Gauges	Operation / Maintenance Manual
22 05 29	Plumbing Hangers and Supports	Product Data
22 05 29	Plumbing Hangers and Supports	Shop Drawings
22 05 29	Plumbing Hangers and Supports	Certification
22 05 53	Plumbing Identification	Product Data
22 07 19	Plumbing Piping Insulation	Product Data
22 10 00	Plumbing Piping	Product Data
22 11 19	Plumbing Specialties	Product Data
22 11 19	Plumbing Specialties	Operation / Maintenance Manual
22 21 23	Plumbing Pumps	Product Data
22 21 23	Plumbing Pumps	Warranty
22 30 00	Plumbing Equipment	Product Data
22 30 00	Plumbing Equipment	Operation / Maintenance Manual
22 40 00	Plumbing Fixtures	Product Data
22 40 00	Plumbing Fixtures	Shop Drawings
23 05 00	Basic HVAC Requirements	Shop Drawings
23 05 00	Basic HVAC Requirements	Product Data
23 05 13	Electrical Requirements for Mechanical Equipment	Operation / Maintenance Manual
23 05 29	HVAC Hangers and Supports	Product Data
23 05 29	HVAC Hangers and Supports	Operation / Maintenance Manual
23 05 53	HVAC Identification	Product Data
23 05 93	Testing, Adjusting, and Balancing	Product Data
23 07 13	Ductwork Insulation	Product Data
23 09 93	Sequence of Operation	Shop Drawings
23 31 13	Ductwork	Shop Drawings
23 31 13	Ductwork	Product Data
23 33 00	Ductwork Accessories	Product Data
23 34 23	Power Ventilators	Product Data
23 37 00	Air Outlets and Inlets	Product Data
23 74 13	Packaged Rooftop Units	Product Data
23 74 13	Packaged Rooftop Units	Operation / Maintenance Manual
23 74 13	Packaged Rooftop Units	Warranty
26 00 00	Electrical Work	Product Data
26 00 00	Electrical Work	Shop Drawings
26 00 00	Electrical Work	Operation / Maintenance Manual
26 00 00	Electrical Work	Test Report
31 10 00	Site Clearing	Shop Drawings
31 20 00	Earth Moving	Product Data
31 20 00	Earth Moving	Test Report
31 22 19	Site Grading	Sample
31 22 19	Site Grading	Test Report
32 13 13	Concrete Paving	Mock Up
32 13 73	Concrete Paving Joint Sealants	Product Data
32 13 73	Concrete Paving Joint Sealants	Sample

32 13 73	Concrete Paving Joint Sealants	Certification
32 13 73	Concrete Paving Joint Sealants	Test Report
32 15 40	Crushed Stone Surfacing (Decomposed Granite)	Product Data
32 15 40	Crushed Stone Surfacing (Decomposed Granite)	Sample
32 92 00	Turf and Grasses	Product Data
32 92 00	Turf and Grasses	Certification

END OF SECTION 01 33 00

SECTION 01 35 13.28 - SITE SECURITY AND HEALTH REQUIREMENTS (MONG)

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 general Institution rules.
- B. This Section includes requirements for environments that employees are domiciled in, or public participation in program activities in or adjacent to the Scope of Work area:
 - 1. The Contractor shall have the applicable measures specified below in-place any time demolition or construction activities occur in occupied or non-occupied project work areas.
 - 2. The Contractor shall complete all specified cleaning procedures and receive clearance from the Construction Representative prior to removing any barriers and other precautionary measures – even for areas that the employees or public do not occupy during construction.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ACCESS TO THE SITE

- A. The Contractor shall arrange with Facility Representatives to establish procedures for the controlled entry of workers and materials into the work areas at the Facility.
- B. The Contractor shall establish regular working hours with Facility Representatives. The Contractor must report changes in working hours or overtime to Facility Representatives and obtain approval twenty-four (24) hours ahead of time. The Contractor shall report emergency overtime to Facility Representatives as soon as it is evident that overtime is needed. The Contractor must obtain approval from Facility Representatives for all work performed after dark.
- C. The Contractor shall provide the name and phone number of the Contractor's employee or agent who is in charge onsite; this individual must be able to be contacted in case of emergency. The Contractor must be able to furnish names and address of all employees upon

request.

- D. All construction personnel shall visibly display issued identification badges

3.2 FIRE PROTECTION, SAFETY, AND HEALTH CONTROLS

- A. The Contractor shall take all necessary precautions to guard against and eliminate possible fire hazards.
 - 1. Onsite burning is prohibited.
 - 2. The Contractor shall store all flammable or hazardous materials in proper containers located outside the buildings or offsite, if possible.
 - 3. The Contractor shall provide and maintain, in good order, during construction fire extinguishers as required by the National Fire Protection Association. In areas of flammable liquids, asphalt, or electrical hazards, 15-pound carbon dioxide or 20-pound dry chemical extinguishers shall be provided.
- B. The Contractor shall not obstruct streets or walks without permission from the Owner's Construction Representative and Facility Representatives.
- C. The Contractor's personnel shall not exceed the speed limit of 15 mph while at the Facility unless otherwise posted.
- D. The Contractor shall take all necessary, reasonable measures to reduce air and water pollution by any material or equipment used during construction. The Contractor shall keep volatile wastes in covered containers and shall not dispose of volatile wastes or oils in storm or sanitary drains.
- E. The Contractor shall keep the project site neat, orderly, and in a safe condition at all times. The Contractor shall immediately remove all hazardous waste and shall not allow rubbish to accumulate. The Contractor shall provide onsite containers for collection of rubbish and shall dispose of it at frequent intervals during the progress of the Work.
- F. Fire exits, alarm systems, and sprinkler systems shall remain fully operational at all times, unless written approval is received from the Owner's Construction Representative and the appropriate Facility Representative at least twenty-four (24) hours in advance. The Contractor shall submit a written time schedule for any proposed shutdowns.
- G. For all hazardous materials brought onsite, Material Safety Data Sheets shall be on site and readily available upon request at least a day before delivery.
- H. Alcoholic beverages or illegal substances shall not be brought upon the Facility premises. The Contractor's workers shall not be under the influence of any intoxicating substances while on the Facility premises.

3.3 SECURITY CLEARANCES AND RESTRICTIONS

- A. FMDC CONTRACTOR BACKGROUND AND ID BADGE PROCESS
 - 1. All employees of the Contractor and Subcontractor(s) are required to submit fingerprints to the Missouri State Highway Patrol to enable the Office of Administration (OA), Division of Facilities Management, Design and Construction's (FMDC) Contractor Screening program to enter the interior of a state office building unescorted. If no access to the

interior of the building is needed, background screening is not required. FMDC reserves the right to prohibit any employee of the Contractor or Subcontractor(s) from performing work in or on the premises of any facility owned, operated, or utilized by the State of Missouri for any reason.

2. The Contractor, Subcontractor(s), and their employees must comply with the process for background checks and contractor ID badges found on FMDC's website at: <https://oa.mo.gov/facilities/facilities-operations/security-information/fmdc-contractor-background-and-id-badge>.
3. Effective June 1, 2026, FMDC requires all forms to be submitted via the online application system and will no longer accept any other submission format for these required forms. The Contractor or Subcontractor shall submit a signed Missouri Applicant Fingerprint Privacy Notice, Authorization for Release of Information Confidentiality Oath, State Identification Badge Agreement, and a forward-facing photo with no headwear or face coverings and a solid neutral background for each employee at least 45 days prior to the expected project start date to initiate the background check process via FMDC's website at: <https://oa.mo.gov/facilities/facilities-operations/security-information/fmdc-contractor-background-and-id-badge>.
4. The Contractor or Subcontractor shall pay for the cost of such background checks.
5. All employees of the Contractor and Subcontractor(s) approved by FMDC to work at a State facility must obtain a contractor ID badge from FMDC prior to beginning work on-site.
6. Pursuant to section 43.540, RSMo, FMDC participates in the Missouri Rap Back and National Rap Back programs as of August 28, 2023. This means that the Missouri State Highway Patrol, Central Records Repository, and the Federal Bureau of Investigation will retain the fingerprints submitted by each of the Contractor's and Subcontractor's employees, and those fingerprints will be searched against other fingerprints on file, including latent fingerprints. While retained, an employee's fingerprints may continue to be compared against other fingerprints submitted or retained by the Federal Bureau of Investigation, including latent fingerprints.
7. As part of the Missouri and National Rap Back programs, FMDC will receive notification if a new arrest is reported for an employee whose fingerprints have been submitted for FMDC after August 28, 2023. If the employee is performing work on a State contract at the time of the arrest notification, FMDC will request and receive the employee's updated criminal history records. If the employee is no longer performing work on a State contract, FMDC will not obtain updated criminal records.
8. The Contractor or Subcontractor shall require its employees to report all arrests or convictions to the contractor immediately, and the contractor shall notify the state agency at FMDCContractorScreenings@oa.mo.gov within five (5) calendar days of the arrest or conviction.
9. Pursuant to section 43.540, RSMo, the Missouri State Highway Patrol will provide the results of the employee's background check directly to FMDC. FMDC may NOT release the results of a background check to the Contractor or Subcontractor or provide the Contractor or Subcontractor any information obtained from a background check, either verbally or in writing. FMDC will notify the Contractor or Subcontractor only whether an employee is approved to work on State property.
10. The Contractor shall notify FMDC via email to FMDCContractorScreenings@oa.mo.gov if an employee is terminated or resigns from employment with the Contractor or Subcontractor. If the Contractor or Subcontractor does not anticipate performing work on a State contract in the future, the Contractor and Subcontractor must request that FMDC remove its employees from the Rap Back programs. However, if removed from the Rap Back programs, employees will be required to submit new fingerprints should the contractor be awarded another State contract.
11. Upon award of a Contract, the Contractor and Subcontractor(s) should contact FMDC at FMDCContractorScreenings@oa.mo.gov to determine if its employees need to provide a new background check. If a Contractor's or Subcontractor's employee has previously submitted a fingerprint background check to FMDC as part of the Missouri and National

Rap Back programs, the employee may not need to submit another fingerprint search, depending upon the circumstances. The Contractor and Subcontractor(s) understand and agree that FMDC may require more frequent background checks without providing any explanation to the Contractor. The fact that an additional background check is requested by FMDC does not indicate that the employee has a criminal record.

3.4 DISRUPTION OF UTILITIES

- A. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and the Facility Representative before disconnecting electric, gas, water, fire protection, or sewer service to any building.
- B. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and Facility Representative before closing any access drives, and shall make temporary access available, if possible. The Contractor shall not obstruct streets, walks, or parking.

3.5 PROTECTION OF PERSONS AND PROPERTY

A. SAFETY PRECAUTIONS AND PROGRAMS

- 1. The Contractor shall at all times conduct operations under this Contract in a manner to avoid the risk of bodily harm to persons or risk of damage to any property. The Contractor shall promptly take precautions which are necessary and adequate against conditions created during the progress of the Contractor's activities hereunder which involve a risk of bodily harm to persons or a risk of damage to property. The Contractor shall continuously inspect Work, materials, and equipment to discover and determine any such conditions and shall be solely responsible for discovery, determination, and correction of any such conditions. The Contractor shall comply with applicable safety laws, standards, codes, and regulations in the jurisdiction where the Work is being performed, specifically, but without limiting the generality of the foregoing, with rules regulations, and standards adopted pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970 and applicable amendments.
- 2. All contractors, subcontractors and workers on this project are subject to the Construction Safety Training provisions 292.675 RSMo.
- 3. In the event the Contractor encounters on the site, material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), lead, mercury, or other material known to be hazardous, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner's Representative and the Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner's Representative and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless by written agreement of the Owner's Representative and the Contractor. "Rendered Harmless" shall mean that levels of such materials are less than any applicable exposure standards, including but limited to OSHA regulations.

B. SAFETY OF PERSONS AND PROPERTY

- 1. The Contractor shall take reasonable precautions for safety of, and shall provide protection to prevent damage, injury, or loss to:

- a. clients, staff, the public, construction personnel, and other persons who may be affected thereby;
 - b. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor or the Contractor's Subcontractors of any tier; and
 - c. other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.
2. The Contractor shall give notices and comply with applicable laws, standards, codes, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury, or loss.
 3. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including, but not limited to, posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.
 4. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.
 5. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in this Section caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, and for which the Contractor is responsible under this Section, except damage or loss attributable solely to acts or omissions of Owner or the Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's other obligations stated elsewhere in the Contract.
 6. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, and the maintaining, enforcing and supervising of safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner's Representative and Architect. The Contractor shall hold regularly scheduled safety meetings to instruct Contractor personnel on safety practices, accident avoidance and prevention, and the Project Safety Program. The Contractor shall furnish safety equipment and enforce the use of such equipment by its employees and its subcontractors of any tier.
 7. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
 8. The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with the Work which cause death, lost time injury, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately.
 9. The Contractor shall promptly notify in writing to the Owner of any claims for injury or damage to personal property related to the work, either by or against the Contractor.
 10. The Owner assumes no responsibility or liability for the physical condition or safety of the Work site or any improvements located on the Work site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time concerning any failure by the Contractor or any Subcontractor to comply with the requirements of this Paragraph.
 11. In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences or procedures or for safety

precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents.

12. The Contractor shall maintain at his own cost and expense, adequate, safe and sufficient walkways, platforms, scaffolds, ladders, hoists and all necessary, proper, and adequate equipment, apparatus, and appliances useful in carrying on the Work and which are necessary to make the place of Work safe and free from avoidable danger for clients, staff, the public and construction personnel, and as may be required by safety provisions of applicable laws, ordinances, rules regulations and building and construction codes.

END OF SECTION 01 35 13.28

SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for construction facilities and temporary controls including temporary utilities, support facilities, security, and protection.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution
 - 2. Temporary electric power and light
 - 3. Temporary heat
 - 4. Ventilation
 - 5. Telephone service
 - 6. Sanitary facilities, including drinking water
 - 7. Storm and sanitary sewer
- C. Support facilities include, but are not limited to, the following:
 - 1. Field offices and storage sheds
 - 2. Temporary roads and paving
 - 3. Dewatering facilities and drains
 - 4. Temporary enclosures
 - 5. Hoists and temporary elevator use
 - 6. Temporary project identification signs and bulletin boards
 - 7. Waste disposal services
 - 8. Rodent and pest control
 - 9. Construction aids and miscellaneous services and facilities
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Temporary fire protection
 - 2. Barricades, warning signs, and lights
 - 3. Sidewalk bridge or enclosure fence for the site
 - 4. Environmental protection

1.3 SUBMITTALS

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

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

1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:
 - 1. Building code requirements
 - 2. Health and safety regulations
 - 3. Utility company regulations
 - 4. Police, fire department, and rescue squad rules
 - 5. Environmental protection regulations
- B. Standards: Comply with NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”. ANSI A10 Series standards for “Safety Requirements for Construction and Demolition”, and NECA Electrical Design Library “Temporary Electrical Facilities”.
 - 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code”.
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry”.
 - 1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.

2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.
 3. For fences and vision barriers, provide minimum 3/9" (9.5mm) thick exterior plywood.
 4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8" (16mm) thick exterior plywood.
- C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.
- D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary office, shops, and shed.
- E. Paint: Comply with requirements of Division 9 Section "Painting".
1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
 2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
 3. For interior walls of temporary offices, provide two (2) quarts interior latex-flat wall paint.
- F. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of (15) or less. For temporary enclosures, provide translucent, nylon-reinforced laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
- G. Water: Provide potable water approved by local health authorities.
- H. Open-Mesh Fencing: Provide 0.120" (3mm) thick, galvanized 2" (50mm) chainlink fabric fencing 6' (2m) high with galvanized steel pipe posts, 1½" (38mm) ID for line posts and 2½" (64mm) ID for corner posts.

2.2 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Designer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide ¾" (19mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100' (30m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110 to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage rating.

- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixture where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated re-circulation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers, or a combination of extinguishers of NFPA-recommended classes for the exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each Facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 - 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 - 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.

- B. Temporary Electric Power Service: The Owner will provide electric power for construction lighting and power tools. Contractors using such services shall pay all costs of temporary services, circuits, outlet, extensions, etc.
- C. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 - 1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- D. Temporary Heating and Cooling: The normal heating and/or cooling system of the building shall be maintained in operation during the construction. Should the Contractor find it necessary to interrupt the normal HVAC service to spaces, which have not been vacated for construction, such interruptions shall be pre-scheduled with the Construction Representative.
- E. Temporary Toilets: Install self-contained toilet units. Use of pit-type privies will not be permitted. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
 - 1. Shield toilets to ensure privacy.
 - 2. Provide separate facilities for male and female personnel.
 - 3. Provide toilet tissue materials for each facility.
- F. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a health and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
 - 1. Provide paper towels or similar disposable materials for each facility.
 - 2. Provide covered waste containers for used material.
 - 3. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
- G. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
 - 1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Storage Facilities: The Owner will provide storage onsite as designated by the Facility Representative or the Construction Representative. Areas for use by the Contractor for storage will be identified at the Pre-Bid Meeting.

- C. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.
- D. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.
- E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
 - 1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.
 - 2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25SqFt (2.3SqM) or less with plywood or similar materials.
 - 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 - 4. Where temporary wood or plywood enclosure exceeds 100SqFt (9.2SqM) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.
- F. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
 - 1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
 - 2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- G. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
- H. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80°F (27°C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.
- I. Rodent Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

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

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Designer.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonable predictable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers” and NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”.
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project complete installation of the permanent fire-protection facility including connected services and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.
- E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.
 - 1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.
 - 2. Provide plywood fence, 8’ (2.5m) high, framed with (4) 2”x4” (50mm x 100mm) rails, and preservative-treated wood posts spaced not more than 8’ (2.5m) apart.
- F. Covered Walkway: Erect a structurally adequate, protective covered walkway for passage of persons along the adjacent public street. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
 - 1. Construct covered walkways using scaffold or shoring framing. Provide wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar

provisions for protection and safe passage. Extend the back wall beyond the structure to complete the enclosure fence. Paint and maintain in a manner acceptable to the Owner and the Designer.

- G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
 - 1. Storage: Where materials and equipment must be stored and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- H. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Designer requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
 - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances as required by the governing authority.
 - 3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housing.

- b. Replace significantly worn parts and parts subject to unusual operating conditions.
- c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 015000

SECTION 01 74 00 – CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for cleaning during the Project.
- B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
 - 1. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
 - 2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

- A. General
 - 1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
 - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
 - 3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
 - 4. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.
- B. Site:
 - 1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
 - 2. Weekly, inspect all arrangements of materials stored on the site. Re-stack, tidy, or otherwise service all material arrangements.
 - 3. Maintain the site in a neat and orderly condition at all times.

C. Structures:

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

3.2 FINAL CLEANING

- A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.
1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and foreign substances.
 2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 3. Remove petrochemical spills, stains, and other foreign deposits.
 4. Remove tools, construction equipment, machinery, and surplus material from the site.
 5. Remove snow and ice to provide safe access to the building.
 6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 8. Broom clean concrete floors in unoccupied spaces.
 9. Vacuum clean carpet and similar soft surfaces removing debris and excess nap. Shampoo, if required.
 10. Clean transparent material, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 11. Remove labels that are not permanent labels.
 12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 13. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

14. Clean plumbing fixtures to a sanitary condition free of stains, including stains resulting from water exposure.
 15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 16. Clean ducts, blowers, and coils if units were operated without filters during construction
 17. Clean, food-service equipment to a sanitary condition, ready and acceptable for its intended use.
 18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
 19. Leave the Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.
- D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.
1. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner's property.

END OF SECTION 01 74 00

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

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 instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
 - 3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Coordination". Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.

- h. Performance curves.
- 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
- 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
- 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning

- e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 007213 "General Conditions".
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.

- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

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. Demolition and removal of selected portions of building or structure.
 - 2. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary of Work" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.

2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs.
 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Predemolition Photographs or Video: Submit before Work begins.

1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

- A. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

- b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- B. Existing Services/Systems to Be Remain: Where services and systems that are to remain are impacted by the removal or demolition of other work (i.e. removal of ceiling grid that support lights and/or diffusers), the Contractor shall restore the services and systems back to original operation and/or location using materials, supports, and requirements outlined in the project specifications without additional compensation.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Store items in a secure area until delivery to Owner.
2. Transport items to Owner's storage area designated by Owner.
3. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 30 01 – CAST-IN-PLACE CONCRETE – SITE WORK

PART 1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work shall include all labor, materials, and equipment necessary to completely furnish and install Cast-In-Place concrete as indicated on the plans and as herein specified.
- B. This Section includes the following:
 - 1. Cast-in-place concrete for site work only.
 - 2. Form-work.
 - 3. Reinforcing.
 - 4. Mix design.
 - 5. Placement procedures.
 - 6. Finishes.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. See Section 32 "Concrete Paving".

1.3 SUBMITTALS

- A. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design tests, and quality control tests as specified.
 - 1. Submit written reports including strength test reports to Landscape Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Both mix designs and test data supporting mix design shall have been completed within the twelve-month period preceding the first placement of concrete on this project. Design mixes and test reports completed prior to that time are not acceptable. Do not begin concrete production until mixes have been approved by the Landscape Architect/Engineer.
 - 2. Submit aggregate gradation data, if available aggregate does not meet the requirements of Section 2.3 Concrete Materials, to Landscape Architect at least 15 days prior to start of work.
- B. Product data for proprietary materials and items.

- C. Shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" and ACI 315R "Manual of Engineering and Placing Drawings for Reinforced Concrete" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement and plan drawing showing placement layout. Include special reinforcement required at openings through concrete structures.
1. One submittal shall be provided for all concrete reinforcement components in an area (i.e., foundations, dowels, wall reinforcing, etc.) Separate packages will not be reviewed.
 2. Any deviations from Construction Documents shall be clearly noted for verification.
 3. Forming / top of wall layout drawings for poured walls.
 4. Construction Joints in Concrete Stairs on Grade: At concrete stairs exceeding 8'-0" in width, submit construction joint layout for review and approval by Landscape Architect/Engineer at least 15 days prior to start of work.
- D. Submit product literature of bonding agent to be used and provide sample of repair for review and approval by Landscape Architect/Engineer prior to commencement of repair operation.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
1. ACI 318, "Building Code Requirements for Reinforced Concrete".
 2. ACI 301, "Specifications for Structural Concrete for Buildings".
 3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".
- B. Concrete Testing Service: The Contractor will engage a testing laboratory acceptable to Landscape Architect/Engineer to perform material evaluation tests and to design concrete mixes.
- C. Materials and installed work may require testing and re-testing at any time during progress of work. Tests shall be done at Contractor's expense.
- D. A single supplier shall be used for exposed concrete.
- E. Mockups: Cast concrete slab-on-grade to demonstrate colored concrete.
1. Build panel approximately 3 sq. ft. for slab-on-grade in the location indicated or, if not indicated, as directed by Landscape Architect.
 2. Approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

PART 2. PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Metal or approved exterior grade plywood. Provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
 - 1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.
- B. Forms for Unexposed Finish Concrete: Plywood or metal. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Provide commercial formulation form-coating compounds with a maximum VOC (volatile organic compound) content of 350 g/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- D. Carton Forms: Biodegradable paper surface, treated for moisture-resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no corrodible metal closer than 1½ inches to exposed surface.
 - 1. Provide ties that, when removed, will leave holes not larger than 1 inch diameter in concrete surface.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed. Grade 40 may be used for stirrups and ties.
- B. Epoxy-Coated Reinforcing Bars: ASTM A 615, grade 60, deformed bars, epoxy coated, with less than 2 percent damaged coating in each 12 inch bar length.
 - 1. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.
- C. Supports for Reinforcement: Bolsters, chairs, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI Specifications.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or use stainless steel supports (CRSI, Class2).

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type IL, or Type II.
- B. Normal Weight Aggregate: ASTM C 33, and as herein specified. Provide aggregates from a single source throughout project unless otherwise acceptable to the Engineer. Coarse aggregates shall meet the requirements for use in regions of moderate weathering. Nominal maximum sizes of aggregates shall not exceed the following limits.
 - 1. Sections whose minimum thickness is 12" or more: 1-1/2".
 - 2. Sections whose minimum thickness is less than 12": 3/4".
- C. Water: ASTM C94.
- D. Admixtures, General: Admixtures for concrete shall contain not more than 0.1 percent chloride ions.
 - 1. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
 - 2. Water-Reducing Admixture: ASTM C 494, Type A.
 - 3. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
 - 4. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.
 - 5. Water-Reducing, Retarding Admixture: ASTM C 494, Type D
 - 6. Fly Ash. ASTM C 618, Class C.
 - a. Wall and foundation concrete may contain up to 30 percent fly ash.
 - b. Exposed concrete work including exterior slabs may contain up to 15 percent fly ash.
 - c. Flatwork concrete that is not exposed may contain up to 15 percent fly ash.
 - 7. Other admixtures may be proposed subject to compliance with the requirements of this section and the approval of the Landscape Architect/Engineer.
- E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 - 1. 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Davis Colors.
 - b. Or equal if and as specifically approved by Landscape Architect by Addendum during the bidding period.
 - 2. Color: As selected by Landscape Architect from manufacturer's full range.

2.4 CURING MATERIALS

- A. General: See Part 3 "Execution", requirements for selection of curing materials.
- 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.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

- D. Water: Potable.
- E. Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A or Class B.

2.5 RELATED MATERIALS

- A. Granular Base: Clean mixture of crushed stone or crushed or uncrushed gravel to provide, when compacted, a smooth and even surface below slabs on grade in locations as noted on drawings. Mixture shall comply with the following: 100 percent passing a 1 1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm).
- B. Patching Compound: Cement-based compound for applications from one inch thick to feathered edges.
- C. Bonding Compound: Polyvinyl acetate or acrylic base.
- D. Foam Expansion Joint Filler: Polyethylene closed-cell expansion-joint filler. Provide WR Meadows, Deck-O-Foam expansion joint filler or equal.
- E. Joint Sealer: ASTM C 920, See Specification Section 07900 for requirements.
- F. Chemical Hardener/Sealer: Hardener, dustproofer and sealer consisting of a water soluble inorganic silicate-based compound. Hardener/sealer shall incorporate a gray color packet per manufacturer's recommendations.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Structure Concrete Sealer, Midwest Floor Care, Inc., Adams, NE.
- b. Sonneborn, Kure-N-Harden, Degussa Building Systems, Shakopee, MN.
- c. Hydrozo, Enviroseal 20, Degussa Building Systems, Shakopee, MN.
- d. Seal Hard, L & M Construction Specialties, Omaha, NE.
- e. Other, equal, if and as specifically approved by Landscape Architect by Addendum during bidding period.

2.6 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by laboratory trial batch as specified in ACI 301. Use an independent testing facility acceptable to the Landscape Architect/Engineer for preparing and reporting proposed mix designs.
- B. Submit written reports to Landscape Architect of proposed mix. Do not begin concrete production until proposed mix designs have been approved by Landscape Architect/Engineer.
- C. Design mixes to provide normal weight concrete with the following properties, unless otherwise indicated on drawings and schedules:
 - 1. All concrete shall have a 28 day F'c = 4500 psi.
- D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches.
 2. Other concrete: Not less than 1 inch nor more than 4 inches.
- E. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
1. Slabs on grade and grade beams shall have a 28 day F'c = 4500 psi; water-cement ratio between 0.40 and 0.45.
- F. Mix design adjustments may be requested when characteristics of materials, job conditions, weather, or other circumstances warrant. Laboratory test data for revised mix design and strength test results must be submitted to and accepted by Landscape Architect/Engineer before using in work.

2.7 ADMIXTURES

- A. Show clearly on all submittals which admixtures if any are to be used in each concrete mix. Do not use any admixture whose use has not been approved by the Landscape Architect/Engineer.
- B. Use air-entraining admixture in all exterior concrete in accordance with ACI 301 requirements.
1. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content within the following limits:
 - a. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
 - 1) 4.5 percent to 7 percent air.
- C. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.
- D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.8 CONCRETE MIXING

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as specified.
- B. Addition of water to the batch at the job site is permitted but subject to the limitations of ACI 301.
- C. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3. EXECUTION

3.1 FORMS

- A. General: Design, erect, support, brace, and maintain formwork according to ACI 301 to support all loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position indicated on drawings within tolerance limits of ACI 117. Maintain formwork construction tolerances complying with ACI 347R.
- B. Construct forms to sizes and shapes shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
- C. When using form coating compound, coat contact surfaces of forms before reinforcement is placed. Apply form coating compound in compliance with manufacturer's recommendations. Rust-stained steel formwork is not acceptable.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, recesses, and the like, for easy removal.
- E. Provide temporary openings for clean-outs and inspections where interior area of concrete is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- G. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces.
- H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before concrete placement as required to prevent mortar leaks and maintain proper alignment.
- J. Form Removal:
 - 1. Formwork not supporting weight of concrete. Formwork for columns, walls, sides of beams and other parts not supporting the weight of concrete may be removed 24 hours after completion of placement of concrete, provided concrete is sufficiently hardened not to be damaged by removal operations and provided curing and protection of work are maintained.
 - 2. Top forms and sloping surfaces. Remove as soon as concrete has attained sufficient strength to prevent sagging. Make necessary repairs, finish as specified, and apply any required treatments as soon as possible and begin specified curing.
 - 3. Formwork supporting weight of concrete. Do not remove forms supporting weight of concrete in beams, slabs and other members until concrete has achieved not less than

85% of its specified 28-day strength. The strength of the concrete at any age shall be determined by the testing of two cylinders made and cured in accordance with ASTM C 39. The strength shall be assumed to be the average of the strength of the two cylinders tested. However, forms shall not be removed if the strength of either of the two cylinders tested is less than 75% of the specified 28-day strength. Alternately, forms supporting weight of concrete may be removed if reshoring is provided to support the full weight of the concrete. Remove forms and install reshores so that concrete is fully supported at all times. Leave reshores in place until concrete has achieved not less than 85% of its specified 28-day strength, determined as specified above.

4. Void forms. Do not remove.

K. Re-use of forms:

1. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
2. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Landscape Architect.

3.2 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.
1. Avoid cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages to vapor retarder/barrier before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Do not bend bars in field except as specifically indicated on the drawings or approved by Landscape Architect/Engineer. If bending is permitted, bend bars cold and in accordance with the requirements of ACI 315.
- D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by bolsters, chairs or other devices.
1. Do not secure reinforcement to re-bar driven into ground or on rocks, dirt clods or other debris. Do not "float in" reinforcement.
- E. Place reinforcement to obtain minimum coverages as required by ACI 318 for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- F. Install welded wire fabric in as long lengths as practicable on bar supports to minimize sagging. Lap adjoining pieces at least one full mesh. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.3 JOINTS

- A. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated. Do not continue reinforcement through sides of strip placements.
- B. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- C. Horizontal and vertical keyways not less than 1.5 inches deep x 3.5 inches wide shall be provided at all construction joints in walls, grade beams and footings.
- D. Expansion Joints in Exterior Slabs-on-Grade: If spacing not indicated, construct exterior expansion joints in paving at 100 foot maximum intervals (at non-climate controlled concrete) and at points of contact between paving, sidewalks, etc and vertical surfaces, such as columns, foundations, reentrant and outside corners, and elsewhere as indicated on drawings.
- E. Provide joint fillers and sealant at all expansion joints.
- F. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade. Use saw cuts 1/8 inch wide by 1/3 slab depth followed by chaser blade w/ 1/8" radius max.
 - 1. If joint spacing not indicated, lay out joints to form square panels. When this is not practical, rectangular panels can be used if the long dimension is no more than 1.25 times the short side. In 4" slabs, the long side should not exceed 10 feet.

3.4 INSTALLATION OF EMBEDDED ITEMS

- A. Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached to embeddings.

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Remove debris, dirt clods, etc. from trenches and excavations prior to concrete placement. Notify and coordinate with other trades to permit installation of their work.
- B. General: Comply with the most current version of ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
 - 1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

- a. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 301.
 2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- E. Cold Weather Placing. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions or low temperatures in compliance with the most current version of ACI 306 "Cold Weather Concreting" and as specified.
1. When air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit within four hours after the finishing of placement operations, uniformly heat water and aggregates before mixing to obtain a concrete mixture of not less than 50 degrees Fahrenheit, and not more than 80 degrees Fahrenheit at point of placement. Do not bring heated water into direct contact with cementitious materials.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt and other materials containing anti-freeze agents or chemical accelerators, unless otherwise accepted in mix designs.
- F. Hot Weather Placing. When hot weather conditions exist that would impair quality and strength of concrete, place concrete in compliance with the most current version of ACI 305 "Hot Weather Concreting" and as specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees Fahrenheit. Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing.
 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
 4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Landscape Architect.

3.6 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Fins and other projections shall be completely removed and smoothed.
- B. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

3.7 MONOLITHIC SLAB FINISHES

- A. Float Finish: Apply float finish to all monolithic slab surfaces prior to trowel or non-slip broom finish.
 - 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances required by ASTM E 1155. Cut down high spots and fill low spots. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
 - 2. Concrete adjacent to all floor drains shall be finished level to drain inlet. Warping of slab is prohibited unless approved in writing by the Landscape Architect.
- B. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete flatwork.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Landscape Architect before application.

3.8 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the most current version of ACI 306.1 for cold-weather protection and with recommendations in the most current version of ACI 305R for hot-weather protection during curing.
- B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- C. Cure concrete according to ACI 308-92, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 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. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Immediately after the concrete has been finished, the concrete surface shall be sealed with a uniform application, no less than 1 gallon per 200 square feet, of white pigmented membrane cure ASTM designation C309, Type 1-D, Class B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work
 - 1. Exposed areas to be reviewed by Landscape Architect/Engineer for acceptance.
- 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: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.10 INSTALLATION OF NON-SHRINK GROUT

- A. Preparation for placing.
 - 1. Roughen surface below bearing area with pneumatic tools.
 - 2. Thoroughly clean roughened surface of concrete foundations and soak surface with water for 24 hours prior to grouting. Remove standing water from surfaces before placing grout.
- B. Placing.
 - 1. Place and cure non-shrink grout in strict accordance with manufacturer's printed instructions.
 - 2. Grout must be free of bleeding at recommended water content.
 - 3. Temperature of concrete foundations and baseplates at time of placing grout shall be within limits recommended by grout manufacturer.

3.11 INSTALLATION OF EPOXY GROUT

- A. Verify field conditions before beginning installation of epoxy grout. Do not begin work until all unsatisfactory conditions have been corrected.
- B. Prepare surfaces or drill holes to receive epoxy grout as shown on the Drawings or approved by Landscape Architect/Engineer in accordance with the epoxy manufacturer's written instructions.
- C. Mix epoxy components in accordance with manufacturer's written directions in clean equipment and containers.
- D. Conform to pot life and workability limits set by epoxy manufacturer.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas (including color and texture irregularities) when approved by Landscape Architect. Remove and replace concrete that cannot be repaired and patched to Landscape Architect's approval.
- B. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.
 - 1. Patch and repair of unacceptable concrete surfaces is the responsibility of the Contractor.
 - 2. Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
 - 3. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 - a. This shall include all areas of concrete that have curled due to uneven curing.
 - 4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 5. Submit product literature of bonding agent to be used and provide sample of repair for review by Landscape Architect/Engineer prior to commencement of repair operation.

3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. General: The Contractor shall employ a testing laboratory to perform tests and to submit test reports to the Landscape Architect/Engineer for review.
- B. Sampling and testing for quality control during placement of concrete include the following. Additional tests may be required as directed by Landscape Architect/Engineer.
 - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete exceeding 5 cubic yards plus additional slump tests for each 50 cubic yards more than the first 25 cubic yards of each concrete class placed in any one day. Additional tests when concrete consistency seems to have changed.
 - b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
 - c. Compressive Strength Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured specimens except when field-cured test specimens are required.

- d. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each type of concrete exceeding 5 cubic yards plus additional sets for each 50 cubic yards more than the first 25 cubic yards of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required. One set of four specimens is required for concrete pours of an amount less than five cubic yards, if the concrete is to be a part of the building structural system (i.e. footings, piers, walls, columns)
- 2. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
- C. Report test results in writing to Landscape Architect, Structural Engineer, Ready-Mix Producer, and Contractor/Owner within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- D. Additional Tests: Make additional tests of in-place concrete when test results indicate specified strengths and other characteristics have not been attained. Conduct tests by cored cylinders complying with ASTM C 42, or other methods as directed by the Landscape Architect/Engineer.

END OF SECTION 03 30 01

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Plywood backing panels.

1.3 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. RIS: Redwood Inspection Service.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPAA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Engineered wood products.
 - 4. Power-driven fasteners.
 - 5. Powder-actuated fasteners.
 - 6. Expansion anchors.
 - 7. Metal framing anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under covering.

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.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that 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.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- 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.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
1. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

- E. 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.
- F. Application: Treat items indicated on Drawings, and the following:
 - 1. Concealed blocking.
 - 2. Framing for non-load-bearing partitions.
 - 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.
 - 4. Grounds.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. 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.
- D. 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. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) 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 of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as

determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.7 METAL FRAMING ANCHORS

- A. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
 1. Use for wood-preserved-treated lumber and where indicated.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304.
 1. Use for exterior locations and where indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

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, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. 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 (406 mm) o.c.
- G. 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 (2438 mm) 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 (2438 mm) 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- (38-mm actual-) thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.
- H. 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.
- I. 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.
- J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. 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.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with indicated fastener patterns where applicable.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

END OF SECTION 06 10 00

SECTION 07 01 50 - PREPARATION FOR RE-ROOFING

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. Full re-roof of roof areas indicated.
 - 2. Removal of base flashings.
 - 3. Temporary roofing.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary of Work" for use of the premises and phasing requirements.
 - 2. Section 01 50 00 "Construction Facilities and Temporary Controls" for temporary construction and environmental-protection measures for reroofing preparation.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.
- B. Roof Re-Cover Preparation: Existing roofing system is to remain and be prepared for new roof installed over it.
- C. Full Roof Tear-Off: Removal of existing roofing system from deck.
- D. Partial Roof Tear-Off: Removal of selected components and accessories from existing roofing system.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Roofing Re-Roof Conference: Conduct conference at Project site.
 - 1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing system manufacturer's representative; roofing Installer, including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing, including installers of roof deck, roof accessories, and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing system tear-off and replacement, including, but not limited to, the following:
 - a. Re-roofing preparation, including roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system components that are to remain.
 - c. Existing roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
 - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
 - e. Existing roof deck conditions requiring notification of Architect.
 - f. Existing roof deck removal procedures and Owner notifications.
 - g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
 - h. Structural loading limitations of roof deck during reroofing.
 - i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
 - j. HVAC shutdown and sealing of air intakes.
 - k. Governing regulations and requirements for insurance and certificates if applicable.
 - l. Existing conditions that may require notification of Architect before proceeding.

1.7 FIELD CONDITIONS

- A. Existing Roofing System: EPDM membrane roofing.
- B. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations are not disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.
 - 1. Coordinate work activities daily with Owner so Owner can place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
 - 2. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.
- C. Protect building to be re-roofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- E. Conditions existing at time of inspection for bidding are maintained by Owner as far as practical.

- F. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
 - 1. Remove only as much roofing in one day as can be made watertight in the same day.
- G. Hazardous Materials: It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.
 - 1. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 INFILL AND REPLACEMENT MATERIALS

- A. Use infill materials matching existing roofing system materials unless otherwise indicated.
- B. Wood blocking, curbs, and nailers are specified in Section 06 10 00 "Rough Carpentry."

2.2 AUXILIARY REROOFING MATERIALS

- A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Shut off rooftop utilities and service piping before beginning the Work.
- B. Protect existing roofing system that is to be re-roofed.
 - 1. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
- C. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

- D. During re-roofing operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- E. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
 - 1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing roofing system components that are to remain.

3.2 ROOF TEAR-OFF

- A. General: Notify Owner each day of extent of roof tear-off proposed for that day.
- B. Full Roof Tear-Off: Where indicated, remove existing roofing and other roofing system components down to the existing pre-engineered metal building structure.
 - 1. Remove vapor retarder, roof insulation and cover board as applicable.
 - 2. Remove wood blocking, curbs, and nailers.

3.3 PREPARATION

- A. Inspect deck after tear-off of roofing system.
- B. If existing structural surface is unsuitable for receiving new roofing or if structural integrity of structure or decking (if applicable) is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.

3.4 INFILL MATERIALS INSTALLATION

- A. Immediately after roof tear-off, and inspection and repair, if needed, of deck, fill in tear-off areas to match existing roofing system construction.
 - 1. Installation of wood blocking, curbs, and nailers is specified in Section 06 10 00 "Rough Carpentry."
- B. Install new roofing patch over roof infill area. If new roofing is installed the same day tear-off is made, roofing patch is not required.

3.5 BASE FLASHING REMOVAL

- A. Remove existing base flashings. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.
- B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings of same metal, weight or thickness, and finish.
- C. Inspect wood blocking, curbs, and nailers for deterioration and damage. If sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
- D. When directed by Architect, replace parapet framing, wood blocking, curbs, and nailers to comply with Section 06 10 00 "Rough Carpentry."

3.6 DISPOSAL

- A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
 - 1. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 07 01 50

SECTION 07 42 00 – METAL WINDOW PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Infill panels of metal.

1.2 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.3 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
- K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- L. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

- M. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

- A. See Section 01 33 00 - Submittals for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
 - 1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.6 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finish and edge in accordance with panel manufacturer's recommendations.
- B. Store materials in accordance with panel manufacturer's recommendations.

1.8 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
 - 1. Maintain this minimum temperature during and 48 hours after installation.

1.9 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Infill Panels: Insulated, aluminum, with edges formed to fit glazing channel and sealed.
 - 1. Total Nominal Thickness: 1 inch (25.4 mm).
 - 2. Finish: Same as storefront.
 - 3. Products:
 - a. Mapes Industries; Mapes Back Pans: <https://mapes.com/#sle>.
 - b. Citadel Architectural Products; GlazeGuard 1000 WR+: <https://www.citadelap.com>.
 - c. Nudo Products, Inc; Endurex 500: <https://nudo.com>.

2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209/B209M.
- C. Fasteners: Stainless steel.
- D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.
- E. Concealed Flashings: Sheet aluminum, 26 gauge, 0.017 inch (0.43 mm) minimum thickness.
- F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- G. Sealant for Setting Thresholds: Non-curing butyl type.
- H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

PART 3 EXECUTION

4.1 EXAMINATION

- A. Panel surfaces shall be free from defects prior to installation.

4.2 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- C. Weatherseal all joints as required using methods and materials as previously specified.
- D. Separate dissimilar metals using gasketed fasteners and blocking to eliminate the possibility of electrolytic reaction.
- E. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

4.3 ADJUSTING & CLEANING

- A. Remove protective film as soon as possible after installation. Film intentionally left in place after panel installation will be the responsibility of the contractor.
- B. Weep holes and drainage channels must be unobstructed and free from dirt and sealant.

4.4 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 07 42 00

SECTION 07 53 23 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

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. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system.
 - 2. Polyisocyanurate Insulation.
 - 3. Cover Board.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking
 - 2. Section 070150 "Preparation for Re-Roofing" for re-cover board beneath new roofing.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
 - 4. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
 1. Base flashings and membrane terminations.
 2. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- C. Samples for Verification: For the following products:
 1. 12 inch by 12 inch sample of sheet roofing membrane from material used in project.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 1. Submit evidence of complying with performance requirements.
- C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field quality-control reports.
- F. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is FM Global approved for roofing system identical to that used for this Project.
- A. Installer Qualifications: Company specializing in performing work of this section with at least five years of documented experience and manufacturer's certification to install the specified roof system.
 1. Roof foreman and 50% of installing crew must be trained and certified in the installation of specified roofing system. In addition, foreman will be full time at project site through roof completion

B. DELIVERY, STORAGE, AND HANDLING

- C. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- D. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- E. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- F. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
1. Special warranty includes membrane roofing, base flashings, and other components of roofing system.
 2. Warranty Period: 20 years from date of Substantial Completion.
 3. Wind Resistance warranty: 110 MP for 15 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain components including primary roofing materials for roofing system from same manufacturer as membrane roofing to the extent possible.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
 3. Uplift Requirements: Roofing system shall
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: Class 1A-90.
 2. Hail-Resistance Rating: SH
 3. Minimum Wind Speed Warranty: 72 MPH.
- D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 EPDM ROOFING

- A. EPDM: ASTM D 4637, Type I, nonreinforced, uniform, flexible EPDM sheet.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Carlisle SynTec Incorporated.](#)
 - b. [Elevate.holcimelevate.com/#sle](#)
 - c. [GAF Materials Corporation.](#)
 - d. [Johns Manville.](#)
 - e. [Mule-Hide Products Co., Inc.](#)
 - f. [Versico Incorporated.](#)
 - g. Or equal, if and as specifically approved by Architect.
 2. Thickness: 60 mils (1.5 mm), nominal.
 3. Exposed Face Color: As selected by Architect from Manufacturer's full range.

2.4 INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation; BASF Neopor GPS: [www.neopor.basf.us/#sle.](#)
 - b. Carlisle SynTec Systems; SecurShield Insulation: [www.carlisle-syntec.com/#sle.](#)

- c. DuPont de Nemours, Inc: building.dupont.com/#sle.
- d. GAF: www.gaf.com/#sle.
- e. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
- f. Verisco Roofing Systems; SecurShield Insulation: www.versico.com/#sle.

2.5 COVER BOARDS

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
 - 1. Thickness: 1/2 inch (12.7 mm), fire resistant.
 - 2. Products:
 - a. Georgia-Pacific; DensDeck: www.densdeck.com/#sle.
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company; DEXcell Glass Mat Roof Board: www.goldbondbuilding.com/#sle.
 - c. USG Corporation; Securock Ultralight Glass-Mat Roof Board: www.usg.com/#sle.

2.6 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
 - 3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.
- C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55- to 60-mil- (1.4- to 1.5-mm-) thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.
- D. Bonding Adhesive: Manufacturer's standard, water based.

- E. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- F. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- G. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- H. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.
- I. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- J. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- K. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- L. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.
- M. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
- N. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
 - 1. Provide white flashing accessories for white EPDM membrane roofing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in "Steel Decking."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

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

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system if applicable.

3.4 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.
- F. Apply roofing with side laps shingled with slope of roof deck where possible.
- G. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to

ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.

1. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.
- I. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- J. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.
- K. Adhere protection sheet over membrane roofing at locations indicated.

3.5 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.7 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for

deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 53 23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, roofing expansion joint assemblies, and other items indicated in Schedule.
- B. Sealants for joints within sheet metal fabrications.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.
- B. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.3 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.
- F. CDA A4050 - Copper in Architecture - Handbook; current edition.
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, (0.0239) inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As selected by Architect from manufacturer's full range of custom colors.
- B. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gauge, (0.0156 inch) (0.40 mm) thick; smooth No. 4 - Brushed finish.

2.2 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
- G. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.3 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: SMACNA (ASMM) Rectangular profile.
- B. Downspouts: Rectangular profile.
- C. Gutters and Downspouts: Size indicated.
- D. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- E. Downspout Boots: Cast iron.
- F. Seal metal joints.

2.4 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Underlayment: ASTM D226/D226M, organic roofing felt, Type I (No. 15).
- C. Primer: Zinc chromate type.
- D. Concealed Sealants: Non-curing butyl sealant.
- E. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.3 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.
- E. Secure gutters and downspouts in place with concealed fasteners.
- F. Slope gutters 1/4 inch per 10 feet (2.1 mm per m), minimum.
- G. Connect downspouts to downspout boots, and grout connection watertight.

3.4 SCHEDULE

- A. Fascia and Cornices:

- B. Gutters and Downspouts:
- C. 1. Material: Pre-Finished Galvanized Steel
- D. Sheet Metal Roof Expansion Joint Covers, and Roof-to-Wall Joint Covers:
- E. 1. Material: Stainless Steel
- F. Counterflashings at Roofing Terminations (over roofing base flashings):
- G. 1. Material: Pre-Finished Galvanized Steel
- H. Counterflashings at Curb-Mounted Roof Items:
- I. 1. Material: Pre-Finished Galvanized Steel
- J. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports:
- K. 1. Material: Stainless Steel

END OF SECTION 07 62 00

SECTION 07 72 53 - SNOW GUARDS

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. Pad-type, flat-mounted snow guards.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for snow guards.
- B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.
 - 1. Include calculation of number and location of snow guards based on snow load, roof slope, roof type, components, spacings, and finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of snow guard, for tests performed by manufacturer and witnessed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

- B. Structural Performance:
 - 1. Snow Loads: As indicated on Drawings.

2.2 PAD-TYPE SNOW GUARDS

- A. Flat-Mounted Metal Snow Guard Pads:
 - 1. Material: Manufacturer's standard noncorrosive metal.
 - 2. Finish and Color: Powder coat; Color to match EPDM roofing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.
 - 1. Verify compatibility with and suitability of substrates including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare substrates for bonding snow guards.
- B. Prime substrates according to snow guard manufacturer's written instructions.

3.3 INSTALLATION

- A. Install snow guards according to manufacturer's written instructions. Space rows as recommended by manufacturer.
- B. Attachment for EPDM Membrane Roofing:
 - 1. Do not use fasteners that will penetrate EPDM roofing, or fastening methods that void EPDM roofing finish warranty.

END OF SECTION 07 72 53

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sealants, not specified elsewhere, as indicated in Contract Documents.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch (13-mm) wide joints formed between two 6-inch (150-mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
 - 1. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 - 2. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.

3.4 CLEANING

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

3.5 PROTECTION

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

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - 1. Joint Sealant: Urethane, NS, 50, NT.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
 - a. Tile control and expansion joints.
 - b. Vertical joints on exposed surfaces of unit masonry concrete walls and partitions.
 - c. All vertical interior urethane resisting joints.
 2. Joint Sealant: Urethane, NS, 50, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
1. Joint Locations:
 - a. All interior joints not otherwise indicated.
 2. Joint Sealant: Acrylic latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 2. Joint Sealant: Silicone, mildew resistant.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 08 71 00 "Door Hardware".
 - 2. Section 08 14 16 "Flush Wood Doors".

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door Products; an Assa Abloy Group company.
 - 2. Curries Company; an Assa Abloy Group company.
 - 3. Republic Doors and Frames.
 - 4. Steelcraft; an Ingersoll-Rand company.
 - 5. West Central Manufacturing
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. All interior locations.

1. Physical Performance: Level B according to SDI A250.4.
2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - b. Construction: Full profile welded.
3. Exposed Finish: Prime.

2.4 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- J. Bituminous Coating: Cold-applied asphalt mastic, 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.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

- b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
 - 6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- C. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.

- d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
- a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Grout jamb members full.
4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
6. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
- a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.2 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.

1.3 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- F. UL (DIR) - Online Certifications Directory; Current Edition.
- G. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- H. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.
- I. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.4 SUBMITTALS

- A. See Section 01 33 00 – Submittals, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

- D. Samples: Submit two samples of door construction, 10 by 10 inches (250 by 250 mm) in size cut from top corner of door.
- E. Samples: Submit two samples of door veneer, 8 by 8 inches (200 by 200 mm) in size illustrating wood grain, stain color, and sheen.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Warranty, executed in Owner's name.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Quality Certification:
 - 1. Provide designated labels on shop drawings as required by certification program.
 - 2. Provide designated labels on installed products as required by certification program.
 - 3. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.7 WARRANTY

- A. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Wood Veneer Faced Doors:

1. Haley Brothers: www.haleybros.com/#sle.
2. Eggers Industries
3. Graham Manufacturing Corporation
4. Marshfield Door Systems, Inc.
5. VT Industries, Inc: www.vtindustries.com/#sle.

2.2 INTERIOR FLUSH WOOD DOORS

- A. Doors: See drawings for locations and additional requirements.
 1. Quality Standard: Custom Grade, Extra Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), AWMAC/WI (NAAWS) or WDMA I.S. 1A.
 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 1. Provide solid core doors at each location.
 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 3. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft (0.01524 cu m/s/sq m) of door opening at 0.10 inch wg (24.9 Pa) pressure at both ambient and elevated temperatures for "S" label; if necessary, provide additional gasketing or edge sealing.

2.3 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.

2.4 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: White oak, veneer grade in accordance with quality standard indicated, rift cut (only red and white oak), with slip match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

2.5 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

2.6 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
 - 1. Transparent:
 - a. System - TR-8, UV Cured Acrylated Polyester/Urethane.
 - b. Marshfield Clear #0-95 or equal.
 - c. Sheen: Satin.

2.7 ACCESSORIES

- A. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.

- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.3 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION 08 14 16

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Other Action Submittals:
 - 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - c. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - 5) Fastenings and other pertinent information.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- B. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of door hardware from a single manufacturer.
 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.
- C. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys and permanent cores to Owner.

1.8 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Exit Devices: Two years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.
 - c. Concealed Floor Closers: Five years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
 - 2. Provide dust boxes for all doors compatible with scheduled hardware, whether scheduled or not.

2.2 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.

- b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
- 3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
- 4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
- 5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.3 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Replace construction cores with permanent cores as directed by Owner.
 2. Furnish permanent cores to Owner for installation.
- E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 01 79 00 "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

- A. The hardware sets listed below represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflict hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process.
- B. Existing Conditions: Where doors/frames are to be reused verify existing door conditions and notify architect of any required changes to specified hardware prior to ordering hardware. Provide additional hardware if required.
- C. Owner to provide keying schedule.

HARDWARE SET: 01

FOR USE ON DOOR #(S):

112

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1		652	IVE
1	EA	STOREROOM LOCK	9K37D 15D		626	BES
1	EA	SURFACE CLOSER	4040XP		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE SET: 02

FOR USE ON DOOR #(S):

111

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1		652	IVE
1	EA	PUSH PLATE	8200 4" X 16"		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		630	IVE
1	EA	SURFACE CLOSER	4040XP		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE SET: 03

FOR USE ON DOOR #(S):

110

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1		652	IVE
1	EA	PRIVACY SET W/ INDICATOR	45H0L 15R VIN		626	BES
1	EA	SURFACE CLOSER	4040XP		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

END OF SECTION 08 71 00

SECTION 08 83 00 - MIRRORS

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 the following types of silvered flat glass mirrors:
 - 1. Annealed monolithic glass mirrors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Samples: For each type of the following:
 - 1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
 - 2. Mirror Clips: Full size.
 - 3. Mirror Trim: 12 inches long.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of mirror.
- C. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.
- D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.
 - 1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- B. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C 1503.
- B. **Annealed Monolithic Glass Mirrors:** Mirror Select Quality, ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission. Provide surface-mount mirrors with polished edges (see drawings). Installation shall be as designated on drawings with concealed fasteners method.
 - 1. Nominal Thickness: 6.0 mm.
 - 2. Unframed with polished edges.

- C. **Tempered Glass Mirrors:** Mirror Glazing Quality for blemish requirements and complying with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear. Provide surface-mount mirrors with polished edges (see drawings). Installation shall be as designated on drawings with mastic adhesive method.
 - 1. Nominal Thickness: 6.0 mm.
 - 2. Unframed with polished edges.
- D. Safety Glazing Products: For tempered mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
 - 1. Adhesive shall have a VOC content of **70** g/L or less.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 FABRICATION

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Flat polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
 - 1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with mastic:
 - 1. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 08 83 00

SECTION 08 87 10 – WINDOW FILM

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. Privacy window films.
- B. Related Requirements:
 - 1. Section 01 74 00 "Cleaning" for cleaning and patching procedures.

1.3 PERFORMANCE REQUIREMENTS

- A. Fire Performance: Surface burning characteristics when tested in accordance ASTM E 84:
 - 1. Flame Spread: 25, maximum.
 - 2. Smoke Developed: 450, maximum.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Selection Samples: For each film specified, submit film samples representing manufacturer's film type for the project.
- C. Verification Samples: For each film specified, two samples representing film color and pattern.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years' experience.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years' experience demonstrated in installing products of the same type and scope as specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: 3M Window Film, which is located at: 3M Center Bldg. 0235-02-S-27; St. Paul, MN 55144-1000; Toll Free Tel: 800-480-1704; Tel: 651-733-2222; Fax: 651-737-3446; Email: pneumann@mmm.com; www.3m.com/windowfilm
- B. Acceptable pre-approved Manufacturers—subject to compliance w/ Basis of Design product requirements include:
 - 1. Privacy Film Company - 11101 Resort Road, Suite 108, Ellicott City, Maryland 21042
 - 2. Decorative Films - Design Studio; <https://designstudio.decorativefilm.com/>
 - 3. Llummar - <https://llummar.com/en/>
 - 4. Avery Dennison - Graphics Solutions, 8080 Norton Pky, Mentor, Ohio 44060

2.2 PRIVACY WINDOW FILMS

- A. Basis of Design: 3M Fasara Glass Finishes Film.
 - 1. Physical / Mechanical Performance Properties:
 - a. General: Glass finish field applied application to glass material as visual opaque or decorative film.
 - b. Film: Polyester
 - c. Decorative Pattern: Frost/Matte Fine Crystal # SH2FNCR
 - d. Adhesive: Acrylic, Pressure Sensitive
 - e. Liner: Silicone-coated Polyester
 - f. Average Overall Thickness (Film and Adhesive without Liner): 80 microns (3.2 mils)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
 - 1. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final appearance:
- B. Do not proceed with installation until glass surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using methods recommended by the manufacturer for achieving the best result under the project conditions.

- C. Commencement of installation constitutes acceptance of conditions.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.
- C. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
- D. Apply film to glass and lightly spray film with slip solution.
- E. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
- F. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
- G. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.

3.4 CLEANING AND PROTECTION

- A. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.
- B. Touch-up, repair or replace damaged products before Substantial Completion.
- C. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

END OF SECTION 08 87 10

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
- B. Related Requirements:
 - 1. Section 09 29 00 "Gypsum Board".

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.
- C. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:

- a. Minimum Base-Metal Thickness, unless otherwise indicated:
 - 1) Framing behind standard panels: 0.0269" inches
 - 2) Framing behind impact resistant panels: 0.0329" inches
 - 3) Framing behind tile backer panels: 0.0329 inches

D. Slip-Type Head Joints: Where indicated, provide the following:

- 1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

- 1. Minimum Base Metal Thickness: 0.027 inches

G. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

- 1. Depth: 1-1/2 inches
- 2. Clip Angel: Not less than 1-1/2 inches by 1-1/2 inches, 0.068 inches thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

- 1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
- 2. Depth: As indicated on Drawings.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.018 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Armstrong World Industries, Inc.; Drywall Grid Systems.
- b. Chicago Metallic Corporation; Drywall Grid System.
- c. USG Corporation; Drywall Suspension System.
- d. Or equal, if and as specifically approved by Architect.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

- 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.

- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
- F. Z-Furring Members:
 - 1. Erect insulation, vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches (1219 mm) o.c.
 - 2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.

3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Sound Attenuation Blankets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. American Gypsum.
 - 2. CertainTeed Corp.
 - 3. Georgia-Pacific Gypsum LLC.
 - 4. National Gypsum Company.
 - 5. USG Corporation.
 - 6. Or equal, if and as specifically approved by Architect.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch or 1/4" (at curved walls).
 - 2. Long Edges: Tapered.
- C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch (15.9 mm), Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.

- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Fry Reglet Corp.
 - b. Or equal if and as specifically approved by Architect.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - 3. Finish: Class I Clear Anodic Finish: AA-C12C22A3.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - d. USG Corporation; SHEETROCK Acoustical Sealant.
 - e. Or equal if and as specifically approved by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.

2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Type X: As indicated on Drawings.
 2. Moisture- and Mold-Resistant Type: At all wet wall locations and entirety of shower stall.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- E. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
 2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
1. If control joints are not shown on the drawings they shall be located at a maximum of 30 feet o.c. Coordinate exact location with Architect prior to installation.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.
 4. U-Bead: Use where indicated.
 5. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840 and Gypsum Association GA-214-10.
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 4: All locations.
 - a. Primer and its application to surfaces are specified in **Section 09 91 23 "Interior Painting."**
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.
- C. Related Requirements:
 - 1. Section 09 29 00 "Gypsum Board".

1.3 DEFINITIONS

- A. AC: Articulation Class.
- B. CAC: Ceiling Attenuation Class.
- C. LR: Light Reflectance coefficient.
- D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved.
 - 1. Ceiling suspension system members.
 - 2. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 4. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96)
- C. Samples for Initial Selection: For components with factory-applied color finishes.

- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.
- E. Qualification Data: For testing agency.
- F. Field quality-control test reports.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- H. Research/Evaluation Reports: For each acoustical panel ceiling and components.
- I. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
- C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - c. Protect lighting fixtures and air ducts to comply with requirements for rated assembly.
 - 2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

- a. Smoke-Developed Index: 450 or less.
 - E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - 2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
 - 3. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
 - 4. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."
 - F. Installer Qualifications: Engage an experienced Installer who has successfully installed acoustical ceilings similar to those indicated for Project.
 - G. Coordination of Work: Coordinate layout and installation of acoustical ceiling with other construction that penetrates ceilings or is supported by them.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes
 - B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
 - C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.
- 1.7 PROJECT CONDITIONS
- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.
- 1.8 COORDINATION
- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- 1.9 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. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

2. PRODUCTS

2.1 ACOUSTICAL PANELS

- A. The Drawings are based on panel ceiling types from one manufacturer as listed below. **Another approved manufacturer's system(s) which is/are similar and equivalent nature will be acceptable if specifically approved by Architect.** The drawings are based on the following:

- 1. **Basis-of-Design—APC – 1** Armstrong® Ceiling Systems, Dune Tegular, 1774, 24" x 24" x 5/8", angled, tegular lay-in for 15/16" grid. Color: White. NRC: 0.50. CAC: 35. Light Reflectance: 0.83. Armstrong® Ceiling & Wall Solutions, 2500 Columbia Avenue, Lancaster, PA 17603 (800) 276-7876.

- B. **Acceptable pre-approved Manufacturers—Acoustical Panel Ceilings subject to compliance w/ Basis of Design product requirements include:**

- 1. Armstrong® Ceiling & Wall Solutions
- 2. CertainTeed Ceilings Corporation
- 3. Rockfon® Chicago Metallic®
- 4. Hunter Douglas Architectural Products
- 5. USG Interiors, Inc.

- C. Touch Up Paint for reveal edge panels: Recolor cut edges of reveal or rabbet edge acoustical ceiling panels at border areas and vertical surfaces with manufacturers touch up paint.
- D. When acoustic panels must be cut to install a recessed light or speaker or where it is necessary to surface apply a fire alarm device or thermostat or similar item, the panel should be reinforced by gluing a full-size piece of 1/2" type "X" gypsum drywall to the back surface of the panel.

2.2 METAL SUSPENSION SYSTEMS

- A. The Drawings are based on panel ceiling types from one manufacturer as listed below. Another approved manufacturer's system(s) which is/are similar and equivalent nature will be acceptable if specifically approved by Architect by Addendum during bidding period. The drawings are based on the following:

- 1. Wide-Face, Capped, Double-Web Steel Suspension System: ASTM C 635. Roll formed from pre-painted or zinc-coated cold-rolled steel sheet, 15/16 inch-wide, metal caps on flanges; intermediate-duty system.
 - a. Color: White.

3. EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which ceiling system attaches or abuts for compliance with requirements specified.

3.2 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
- B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. **Adjust as necessary to avoid use of less-than-half-width units at borders, and comply with reflected ceiling plans**

3.3 INSTALLATION

- A. Installation Standard: ASTM C 636, manufacturer's instructions and Cisca "Ceiling Systems Handbook."
- B. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure. Splay hangers only where required to miss objects. Offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
- C. Where width of ducts and other construction within ceiling plenum interfere with required spacing of hangers, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
- D. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts or other devices that are secure and appropriate for substrate. Do not attach hangers to steel roof deck or deck tabs.
- E. Space hangers not more than 4'-0" o.c. along each member and provide hangers not more than 8 inches from ends.
- F. Install edge moldings where necessary to conceal edges of acoustical units.
- G. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.
- H. **Install hold-down clips in areas indicated and in areas required by governing regulations, or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.**

3.4 CLEANING

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

- B. If acoustical panels are removed after initial installation to accommodate work by other trades, clean and reset all panels that have been disturbed.

END OF SECTION 09 51 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Luxury Vinyl Tile
- 2. Resilient Wall Base

1.3 SUBMITTALS

- A. Product data for each type of product specified.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts. **INSTALL the Resilient Floor Tile, Rubber Interlock Tile, and Rubber Tile per manufacturer's instructions, avoiding installation of smaller than half-sized tiles.**
 - 1. Show details of special patterns.
- C. Samples for Verification: Full-size units of each color and pattern of floor tile required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than **9 inches (230 mm)** long, of each color required.
- D. Product Schedule: For floor tile. Use same designations indicated on Drawings.
- E. Qualification Data: For qualified Installer.
- F. Maintenance Data: For each type of floor tile to include in maintenance manuals.
- G. **Test Data: Provide a letter confirming that the concrete substrate meets all specified requirements prior to commencing with floor finish installation. Include in letter, documentation of test results showing passing results.**

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class 1, not less than 0.45 W/sq. cm.
 - 2. Smoke Density: Less than 450 per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver tiles and installation accessories to Project site in original manufacturer's unopened cartons and containers.
- B. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.
 - 1. Move tiles and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than **55 deg F (13 deg C)** or more than **95 deg F (35 deg C)**.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.
- F. Concrete shall have cured no less than 90 days prior to installation of any tile. Installation of carpet on concrete cured less than 90 days shall be at risk of Contractor and shall be replaced if adhesive failure occurs after installation.

1.7 SEQUENCING AND SCHEDULING

- A. Install tiles and accessories after other finishing operations, including painting, have been completed.
- B. Do not install tiles over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. **Floor Tile:** Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed but not less than 5% of each color provided.
 - 2. **Resilient Base:** Furnish not less than **10 linear feet (3 linear m)** for every **500 linear feet (150 linear m)** or fraction thereof, of each type, color, pattern, and size of resilient product installed.

2. PRODUCTS

2.1 RESILIENT FLOOR TILE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Mannington
 - 2. Forbo
 - 3. Interface, Inc.
 - 4. Mohawk Group
 - 5. Tarkett (formerly Johnsonite®)
 - a. LVT-1, Color – As selected by Architect from manufacturer's full range.

2.2 THERMOSET-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following.
 - 1. Burke Mercer Flooring Products, Division of Burke Industries Inc.
 - 2. Flexco
 - 3. Roppe Corporation, USA
 - 4. Tarkett (formerly Johnsonite®)
 - a. Product: Thermoset Rubber Wall Base, 4" H Coved.
 - 1) RB-1 Color: As selected by Architect from manufacturer's full range.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style A, Cove: Provide in areas with resilient flooring.
- C. Thickness: 0.125 inch (3.2 mm).
- D. Height: 4 inches (102 mm)
- E. Lengths: Coils in manufacturer's standard length
- F. Outside Corners: Job-formed
- G. Inside Corners: Job-formed Retain "Colors" Paragraph below if colors are not indicated in a separate schedule.

2.3 INSTALLATION ACCESSORIES

- A. Resilient Edge Strips: 1/8" thick, homogeneous rubber composition, tapered or bullnose edge. Tarkett, 30000 Aurora Road, Solon, OH 44139, (800) 899-8916, https://commercial.tarkett.com/en_US/brand/johnsonite.
 - 1. LVT to Wood Flooring: Tarkett (Johnsonite), EG-48-J. Color —Black.
- B. **Concrete Slab Primer**: Non-staining type as recommended by flooring manufacturer.
- C. **Trowelable Leveling and Patching Compounds**: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- D. **Concrete Primer/Moisture Vapor Reduction System**:
 - 1. As required by resilient flooring manufacturer to comply with high moisture limits on concrete substrate up to:
 - a. 99% insitu Relative Humidity (RH).
 - b. Maximum Surface pH Limit: between 7.0 and 12.0.
- E. **LVT Adhesive**:
 - 1. LVT-1: Provide Manufacturer's recommended commercial-grade adhesive.

3. EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving resilient flooring.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Slabs: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Leveling Compounds:
 - a. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated. **Leveling compounds must be Portland-based cement.**
4. **Alkalinity and Adhesion Testing:** Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing:
 - a. **InterfaceFLOR—XL Brands Stix 5500 Adhesive Test Requirements:** Proceed with installation only after substrates have a pH range of not less than 7 or more than 9 pH.
 - b. **Interface®—XL Brands HM99 High Moisture Adhesive Test Requirements:** Proceed with installation only after substrates have a pH range of not less than 8 or more than 12 pH.
5. **Moisture Testing:** Perform tests, mapping your sensor count and location so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area with test areas evenly spaced in installation areas, and with one additional hole for each additional 1000 sq. ft. (304.8 sq. m).
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. **Relative Humidity Tests:** ASTM F 2170 and ASTM F 2659 tests are both required when using XL Brands HM99 High Moisture Adhesive. Proceed with installation only after substrates pass testing:
 - 1) **Using in situ probes, ASTM F 2170.**
 - a) **InterfaceFLOR—XL Brands Stix 5500 Adhesive Test Requirements:** Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement.
 - b) **Interface®—XL Brands HM99 High Moisture Adhesive Test Requirements:** Proceed with installation only after substrates have a maximum 99 percent relative humidity level measurement.
 - 2) **Using in situ probes, ASTM F 2659.**
 - a) **InterfaceFLOR—XL Brands Stix 5500 Adhesive Test Requirements:** ASTM F2659 test is not required.
 - b) **Interface®—XL Brands HM99 High Moisture Adhesive Test Requirements:** Proceed with installation only after substrates have a maximum 4 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and resilient flooring manufacturers. Proceed with installation only after substrates pass testing.

- 6. **Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.** Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
- C. Fill cracks, holes, and depressions with a cement-based compound, compliant with carpet manufacturer's requirements; installed per manufacturer's specifications and instructions for use.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.
- F. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated. If pattern is not indicated on finish floor plans, consult with Architect/Designer prior to installation.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, non-staining marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

- H. Adhere tile flooring to flooring substrates using a full spread of adhesive applied in compliance with manufacturer's directions to substrate producing a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 INSTALLATION OF ACCESSORIES

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - 2. Tightly adhere to substrates throughout length of each piece.
 - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil. Do not wash floor until after time period recommended by resilient floor tile manufacturer.
 - 4. Clean tiles not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean tiles using method recommended by manufacturer.
- C. **Floor Finishing:** When proper material has been installed correctly, no finish is required. Consult Manufacturers written instructions for final installation.
- D. Cover floor tile until Substantial Completion, protecting flooring against damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 19

SECTION 09 67 13 – BROADCAST-APPLIED FLAKE RESINOUS FLOORING

1. PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Resinous flooring systems with high-build double-broadcast applied flooring system consisting of 100% solids epoxy binder, that consists of epoxy resin and decorative flake with a high-solids, two-component 100% aliphatic urethane topcoat providing a slip-resistant surface on interior concrete floors.
 - 2. Installer pre-approval required.
- B. Related Requirements:
 - 1. Section 09 65 19 "Resilient Tile Flooring".

1.3 PRE-INSTALLATION MEETINGS

- A. Pre-Installation Conference: Conduct conference at Project Site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's technical data, material test reports, application instructions, chemical resistance, surface preparation, and application instructions.
- B. Samples for Initial Selection: For each type of exposed finish and texture required.
- C. Samples for Verification: For each resinous flooring system required, 12 inches (300-mm) square, applied to rigid backing by Installer for this Project.
 - 1. **Samples for review of color and texture.**
- D. **Test Data: Provide a letter confirming that the concrete substrate meets all specified requirements prior to commencing with floor finish installation. Include in letter, documentation of test results showing passing results.**

1.5 INFORMATIONAL SUBMITTALS

- A. Installer Qualifications:
 - 1. Provide documentation of the requirements listed under Quality Assurance.
 - 2. Applicator personnel shall be trained for application of specified materials.

- a. Provide a list of employees trained for application of specified materials.
 3. Provide a list of completed projects including project name and location, name of Architect, name of material manufacturer, and approximate quantity of materials applied.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance data: For resinous flooring to include in maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. **Installer Qualifications:** An authorized representative who employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.
 1. **Qualifications of installers for resinous flooring system shall not be less than seven (7) years of experience installing resinous flooring systems indicated.** Resinous flooring installer shall be manufacturer approved and have performed at least ten similar installations. **Resinous flooring installer shall have a minimum of 1,000,000 square feet of successful applications.**
 2. **Special Coatings System Installers must be pre-approved by the Architect.** Subject to the requirements of the specifications and approval of the manufacturer, pre-approved installers are listed in paragraph 2.3 of this Section.
 - B. **Pre-Application Meeting:** Convene a pre-application meeting two (2) weeks before the start of application of floor coating system. Require attendance of parties directly affecting work of this section, including the Contractor, Architect, Applicator, Manufacturer's Representative. Review the surface preparation, application, cleaning, protection, and coordination with other work.
 - C. **Source Limitations:** Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
 - D. **Mockups:** Apply benchmark samples of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects, color, texture and set quality standards for materials and execution.
 1. Architect will select one surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Floor Surfaces: Provide samples in one room of at least 100 sq. ft.
 2. Simulate finished lighting conditions for Architect's review of mockups.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. **Final approval of textures and color selections will be based on mockups.**
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

1.10 WARRANTY

- A. Manufacturer's written warranty against defects and wear for a period of five (5) years, including:
 1. Delamination from substrate.
 2. Loss of aggregate.
 3. Degradation of finish.
 4. Cracking and spalling
 5. Water penetration.

2. PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Flammability: Self-extinguishing according to ASTM D 635.

2.2 MANUFACTURERS

- A. Source Limitations:
 1. Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer.
 2. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials of type and from manufacturer recommended in writing by manufacturer of primary materials.
- B. Requests for manufacturer substitutions prior to bidding will be reviewed and responded to in conformance with Division 1 requirements.

2.3 INSTALLERS

- A. **Installer must be approved by epoxy resinous flooring manufacturer.** Subject to compliance with requirements engage one of the following Resinous Flooring System Installers:
1. Abstract Painting, Council Bluffs, IA (712) 328-3231.
 2. Desco Coatings, Inc., Olathe, KS (913) 782-3330.
 3. Epoxy Coating Specialists, Kansas City, KS (913) 362-4141.
 4. McGill Brothers, Omaha, NE (402) 556-0915.
 5. Prime Coat Coating Systems, (847) 972-2146.
 6. SCS Flooring, Homestead, IA (319) 622-3049.
 7. Stonhard®, Omaha, NE (302) 983-7097- Chris Pawson, cpawson@stonhard.com.
 8. Surface Sealers, Lincoln, NE (402) 474-2440.
 9. W.S. Bunch Co., Omaha, NE (402) 558-4242.

2.4 RESINOUS FLOORING

- A. Resinous Flooring System: Abrasion-resistant, impact-resistant, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor.
1. **Basis-of-Design—EPX-1:** Tnemec Company—DecoFlake
 2. **Acceptable pre-approved Manufacturers—Broadcast-Applied Decorative Flake Epoxy Resinous Flooring subject to compliance w/ Basis of Design product requirements include:**
 - a. Desco Coatings, Inc.
 - b. Stonhard®, Inc.
 - c. Tennant Company.
- B. Color(s):
1. **EPX-1; Match Architects Sample; Chips Unlimited; Color #B21-2467, 1/8" Flake, Batch Number #1091508**
- C. System Characteristics:
1. Decorative Flake with 100 percent solids according to ASTM D2369. Completely light stable over the normal life of the coating.
 2. Wearing Surface: Medium Textured for slip resistance, match Architect's sample. Integral.
 3. Cove Base: 4 inches high or as noted on drawings.
 4. Overall System Thickness: 3/16-inch (4.8-mm) finish over sloped patching and fill material.
- D. **System Components:** Manufacturer's standard components that are compatible with each other and as follows:
1. **Primer:** Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.
 - a. Basis of Design Product: **Tnemec Company Epoxoprime® Series 201**— High-Solids, Two-Component Moisture-Tolerant Modified Polyamine Epoxy.
 - b. Formulation Description: 100 percent solids.

2. **Floor Slope Build:**

- a. Basis of Design Product: Tnemec Company Surfacing Epoxy Series 215—Modified Polyamine Epoxy. Mix with Portland cement, aggregate and dry silica as recommended by manufacturer.
- b. Formulation Description: 100 percent solids.

3. **Waterproof Membrane:**

- a. Basis of Design Product: Tnemec Company Sub-Flex EP Series 206—Flexible Epoxy, applied at 40 – 50 sf per gal.
- b. Formulation Description: 100 percent solids.

4. **Body Coat**—2 coats:

- a. Basis of Design Product: Tnemec Company Deco-Fleck® Series 224—Modified Polyamine Epoxy.
- b. Formulation Description: 100 percent solids.

5. **Broadcast**—2 coats to refusal:

- a. Broadcast Decorative Flake Aggregate per manufacturer's written instructions.

6. **Coved Base:**

- a. Basis of Design Product: Tnemec Company—Satin-Glaze Series 285—Self-Priming, Two-Component Epoxy Aggregate Mortar to form a rolled radius cove.
- b. Apply a 4" rolled radius cove to all floor wall/curb transitions in accordance with the CSM's written instructions and as indicated on the standard drawing details. Application Rate per manufacturer's written instructions.
- c. Dry Film Thickness: 3/16" (minimum 1/8") DFT.

7. **Grout Coat:**

- a. Basis of Design Product: Tnemec Company Deco-Clear® Series 285—Epoxy. A Two-Component Modified Polyamine Epoxy at 85-125 sq. ft. per gallon.
- b. Dry Film Thickness: 14 - 18 DFT.

8. **Topcoats:** Sealing or finish coats.

- a. Basis of Design Product: Tnemec Company EverThane Series 248—Epoxy. A Three-Component Aliphatic Moisture Cured Urethane Finish Coat(s).
- b. Formulation Description: High Solids.
- c. Type: Clear.
- d. Finish: Satin/Low Sheen—Orange Peel.
- e. Dry Film Thickness: 2.0 – 3.0 DFT.

E. **System Physical Properties:** Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated

- 1. Compressive Strength: 10,700 psi per ASTM C 579.
- 2. Tensile Strength: 2,200 psi per ASTM C 307.
- 3. Flexural Modulus of Elasticity: 4,550 psi per ASTM C 580.

4. Indentation: 2,000 psi according to MIL-D-3134.
 5. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch (1.6-mm) permanent indentation per MIL-D-3134J.
 6. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) per MIL-D-3134J.
 7. Abrasion Resistance: 0.18gm maximum weight loss per ASTM D 4060.
 8. Coefficient of Friction: 0.5 minimum according to STM D-2047.
 9. Hardness: 85 - 90, Shore D per ASTM D 2240.
- F. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected by the following:
1. 20% Hydrochloric Acid.
 2. Mercurochrome.
 3. Betadyne.
 4. Urine.
 5. Coffee.
 6. Ethyl Alcohol.
 7. Iodine.
 8. 10% Lactic Acid.
 9. Tea.
 10. Mustard.

2.5 ACCESSORIES

- A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- B. **Metal Edge Strips:** Metal strips are to be provided by Resinous Flooring Installer and used at transitions between epoxy and adjacent floor finishes.

3. PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
1. Roughen concrete substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
 - c. Create a surface profile similar to ICRI-CSP5.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.

3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1,000 sq. ft. (1.36 kg of water/92.9 sq m) of slab area in 24 hours.
 - b. Plastic Sheet Test: ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
 - c. Relative Humidity Test: Use in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 4. Alkalinity and Adhesion Testing: Verify that concrete substrates have neutral pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Patching and Filling: Use patching and fill and build material to fill holes and depressions in substrates and to provide floor slopes where indicated according to manufacturer's written instructions to build floor surface to the specified slopes. Fill, sand or grind cured floor build to eliminate surface imperfections and trowel marks.
1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.
- D. Resinous Materials: Mix components and prepare according to resinous flooring manufacturer's written instructions.

3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Floor Slope Build: Apply floor slope build product, where indicated, over primed substrate per manufacturer's recommendations.
- D. Reinforcing Membrane: Apply reinforcing membrane to substrate cracks.
- E. Double Broadcast Body Coats: Apply double broadcast body coats to refusal in thickness indicated for flooring system.

- F. Topcoats: Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.
- G. Add glass beads and/or top coats to achieve desired surface texture and uniformity.

3.3 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

- 1. Concrete.
- 2. Clay masonry.
- 3. Concrete masonry units (CMU).
- 4. Steel.
- 5. Cast iron.
- 6. Galvanized metal.
- 7. Aluminum (not anodized or otherwise coated).
- 8. Wood.
- 9. Gypsum board.
- 10. Plaster.
- 11. Spray-textured ceilings.
- 12. Cotton or canvas insulation covering.
- 13. ASJ insulation covering.

- B. Related Sections:

- 1. Division 08 Sections for factory priming doors with primers specified in this Section.
- 2. Division 09 Sections for special use-coatings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

- 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
- 2. Step coats on Samples to show each coat required for system.
- 3. Label each coat of each Sample.
- 4. Label each Sample for location and application area.

- C. Product List: For each product indicated, include the following:

- 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from the same product run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mock-ups: Apply mock-ups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

- 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

- a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.

- 2. Final approval of color selections will be based on mockups.

- a. If preliminary color selections are not approved, apply additional mock-ups of additional colors selected by Architect at no added cost to Owner.

- 3. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Architect specifically approves such deviations in writing.

- 4. Subject to compliance with requirements, approved mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion.

- B. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

- 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L. (Note to Specifier: System FM-31 should be rated as not more than 450 g/L)
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.
 - v. Naphthalene.
 - w. Toluene (methylbenzene)
 - x. 1,1,1-trichloroethane.
 - y. Vinyl chloride.

- D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers".
- E. **Colors: As indicated on drawings.** Note: Match existing where required.

2.2 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
 - 5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Aluminum Substrates: Remove loose surface oxidation.
- I. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
- K. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
- L. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
- M. Spray Textured Ceiling Substrates: Do not begin paint application until surfaces are dry.

- N. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable in writing to topcoat manufacturers.
 6. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures are in place and all areas as specified herein. Extend paint finishes in these areas as required. If color is not designated, the Architect will select from standard colors.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. Ensure that edges, corners, crevices, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces. Recoat primed and sealed surfaces where evidence of unsealed areas in first coat appears.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Allow sufficient time between successive coats to permit proper drying.
- F. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.
- G. Painting includes field painting exposed bare and covered pipes and ducts (**including color coding**), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment including all mechanical equipment and materials. Coordinate with mechanical contractor for appropriate ANSI requirements.
- H. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels. Painting is required on all new items included in the work.
- I. Paint interior surfaces of ducts, where visible through registers or grilles, with a **flat, nonspecular black paint**. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
- J. Finish doors on tops, bottoms and side edges same as faces.
- K. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:

- a. Equipment, including panelboards and switchgear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- E. Provide "wet paint" signs to protect newly painted finishes.

3.6 INTERIOR PAINT SCHEDULE

<u>LOCATION</u>	<u>SHEEN</u>	<u>PAINT SYSTEM</u>
Interior Concrete Slabs—Existing	Sealer	CONC-411
Interior Exposed Structural Ceilings	Flat	ESC-21
Interior Exposed Structural Ceilings	Eggshell	ESC-51
Interior Ferrous Metal	Semi-Gloss	FM-21
Interior Ferrous Metal	Semi-Gloss	FM-31
Interior Ferrous Metal	Semi-Gloss	FM-41
Interior Ferrous Metal	Semi-Gloss	FM-51
Interior Ferrous Metal	Aluminum	FM-61
Interior Ferrous Metal	Gloss	FM-111
Interior Gypsum Drywall /Plaster	Flat	GDW-21
Interior Gypsum Drywall / Plaster	Eggshell	GDW-31
Interior Gypsum Drywall / Plaster	Semi-Gloss	GDW-41

3.7 INTERIOR PAINTING SYSTEMS

A. System CONC-411 for application on Existing Interior Slabs—Sealer:

1. Concrete Sealer Surface Preparation: Follow Manufacturer's written instructions prior to application. All sealers, membrane-curing compounds, paints, wax, coatings, floor coverings and their mastics, as well as any surface contaminants such as oil or food spills must be removed.
 - a. Route and clean non-moving cracks and saw cut, control joints. Fill non-moving cracks and saw cut, control joints with products compliant with concrete sealer manufacturer after the final steps of the process. Moving cracks must be addressed separately.
 - b. Repair large or deep surface irregularities with a rapid setting patching compound that meets the requirements of the project
2. Apply sealer to the surface per manufacturer's written instructions.
3. Concrete Sealer: Penetrating, Concrete Hardener/Sealer for use over existing cured concrete.
 - a. Kaufman Products, Inc: SureHard.
 - b. L&M Construction Chemicals, Inc./Laticrete: Seal Hard.
 - c. W.R. Meadows, Inc.: Liqui-Hard.
 - d. SpecChem, LLC: Spec Hard.
 - e. Or equal, if and as specifically approved by Architect by Addendum during bidding period.

B. System ESC-21 for application on Interior Exposed Structural Ceilings—Flat:

1. Flat Finish: One (1) - Two (2) coats over primer with total dry film thickness, between 3.0 and 4.5 mils thickness per coat.
2. Synthetic, Rust-Inhibiting Primer for non-primed surfaces: Quick-drying, rust-inhibiting primer for priming interior galvanized metal and ferrous metal under waterborne acrylic dry fall coating:
 - a. DV: Vers-Acryl 300 Acrylic DTM Primer.
 - b. Moore: COROTECH® Acrylic Metal Primer, V110.
 - c. PPG Paints: PITT-TECH® Interior/Exterior Primer/Finish DTM Industrial Enamel.
 - d. S-W: DTM Acrylic Primer/Finish Primer, B66 Series.

3. Interior Waterborne Acrylic Dry Fall Flat Finish Coating for use over a primer on interior galvanized metal and ferrous ceiling surfaces, Color - White.
 - a. DV: Luminance Latex Dri-Mist – Flat, 300 / 301.
 - b. Moore: Latex Dry Fall - Flat, 395.
 - c. PPG Paints: SPEEDHIDE® SUPER TECH® Interior Latex Dry-Fog – Flat.
 - d. S-W: Pro Industrial® Waterborne Acrylic Dry Fall – Flat, B42 Series.

C. System ESC-51 for application on Interior Exposed Structural Ceilings—Eggshell:

1. Eggshell Finish: One (1) - Two (2) coats over primer with total dry film thickness, between 3.0 and 4.5 mils thickness per coat.
2. Synthetic, Rust-Inhibiting Primer for non-primed surfaces: Quick-drying, rust-inhibiting primer for priming interior galvanized metal and ferrous metal under waterborne acrylic dry fall coating:
 - a. DV: Vers-Acryl 300 Acrylic DTM Primer.
 - b. Moore: COROTECH® Acrylic Metal Primer, V110.
 - c. PPG Paints: PITT-TECH® Interior/Exterior Primer/Finish DTM Industrial Enamel.
 - d. S-W: DTM Acrylic Primer/Finish Primer, B66 Series.
3. Interior Waterborne Acrylic Dry Fall Eggshell Finish Coating for use over a primer on interior galvanized metal and ferrous ceiling surfaces, Color - White.
 - a. DV: Luminance Latex Dri-Mist - Semi-Gloss, 303.
 - b. Moore: Latex Dry Fall - Eggshell, 396.
 - c. PPG Paints: SPEEDHIDE® SUPER TECH® Interior Latex Dry-Fog - Eggshell.
 - d. S-W: Pro Industrial® Waterborne Acrylic Dry Fall - Eg-Shel, B42 Series, White.

D. System FM-21 for application on Interior Ferrous Metal—Eggshell:

1. Eg-Shel Waterborne Enamel Finish: Two (2) coats over primer with total dry film thickness not less than 2.5 mils.
2. Acrylic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal on the interior under waterborne eggshell enamels. **If interior ferrous metal is shop-primed, contractor shall provide data pages of shop primer for review and approval by Architect to affirm that the shop primer is rust-inhibitive, is designed to accept top coat(s), and the instructions to prep the surface.**
 - a. DV: Vers-Acryl 303 Acrylic DTM Primer/Finish.
 - b. Moore: SSHP Acrylic Metal Primer, P04.
 - c. PPG Paints: PITT-TECH® Interior/Exterior Primer/Finish DTM Industrial Enamel.
 - d. S-W: Pro Industrial™ Pro-Cryl® Universal Primer, B66 Series.
3. Interior Enamel Undercoat: Ready-mixed enamel for use as an undercoat over a primer on ferrous metal under interior eggshell waterborne enamel.
 - a. DV: Vers-Acryl 303 Acrylic DTM Primer/Finish – Mid Sheen
 - b. Moore: ULTRA SPEC® HP D.T.M Acrylic - Low Lustre Enamel, HP25.
 - c. PPG Paints: PITT-TECH® Interior/Exterior Primer/Finish DTM Industrial Enamel – Satin.
 - d. S-W: Pro Industrial™ DTM Acrylic Interior/Exterior - Eg-Shel, #B66 Series.

4. Exterior Waterborne Eggshell Enamel for use over a primer and undercoat on interior ferrous surfaces.
 - a. DV: Vers-Acryl 303 Acrylic DTM Primer/Finish – Mid Sheen.
 - b. Moore: ULTRA SPEC® HP D.T.M Acrylic - Low Lustre Enamel, HP25.
 - c. PPG Paints: PITT-TECH® Interior/Exterior Primer/Finish DTM Industrial Enamel – Satin.
 - d. S-W: Pro Industrial™ DTM Acrylic Interior-Exterior - Eg-Shel, #B66 Series.

E. System FM-31 for application on Interior Ferrous Metal—Semi-Gloss:

1. Semi-Gloss Alkyd Enamel Finish: Two (2) coats over primer with total dry film thickness not less than 2.5 mils.
2. Synthetic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal on the interior under alkyd gloss enamels: .
 - a. DV: Iron Prime 250 Fast Dry Primer.
 - b. Moore: COROTECH® Universal Metal Primer, V131.
 - c. PPG Paints: Devguard Alkyd Rust-Inhibitive Metal Primer.
 - d. S-W: Kem Kromik® Universal Metal Primer, B50 Series.
3. Interior Enamel Intermediate Coat: Ready-mixed enamel for use as an undercoat over a primer on ferrous metal under an interior semi-gloss alkyd enamel.
 - a. DV: CoteAll® Multi-Purpose Alkyd Enamel – Semi-Gloss.
 - b. Moore: FRESH START® Alkyd Enamel Underbody Primer, 217.
 - c. PPG Paints: 7-LINE® Industrial Alkyd 4308 - Gloss.
 - d. S-W: Industrial Enamel V.O.C. Alkyd Gloss Enamel, B-54Z Series.
4. Interior Alkyd Semi-Gloss Enamel for use over a primer and undercoat on interior ferrous surfaces.
 - a. DV: CoteAll® Multi-Purpose Alkyd Enamel – Semi-Gloss.
 - b. Moore: SUPER SPEC® HP D.T.M. Alkyd Enamel – Semi-Gloss, 0P24.
 - c. PPG Paints: 7-LINE® Industrial Alkyd 4308 – Semi-Gloss.
 - d. S-W: Industrial Enamel V.O.C. Alkyd Gloss Enamel, B-54Z Series.

F. System FM-41 for application on Interior Ferrous Metal—Semi-Gloss:

1. Semi-Gloss Waterborne Enamel Finish: Two (2) coats over primer with total dry film thickness not less than 2.5 mils.
2. Acrylic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal on the interior under waterborne semi-gloss enamels. **If interior ferrous metal is shop-primed, contractor shall provide data pages of shop primer for review and approval by Architect to affirm that the shop primer is rust-inhibitive, is designed to accept top coat(s), and the instructions to prep the surface.**
 - a. DV: Vers-Acryl 300 Acrylic DTM Primer.
 - b. Moore: ULTRA SPEC® HP Acrylic Metal Primer, HP04.
 - c. PPG Paints: PITT-TECH® Interior/Exterior Primer/Finish DTM Industrial Enamel.
 - d. S-W: Pro Industrial™ Pro-Cryl® Universal Primer, B66 Series.
3. Interior Enamel Undercoat: Ready-mixed enamel for use as an undercoat over a primer on ferrous metal under interior semi-gloss waterborne enamel.

- a. DV: Finium DTM-AT Acrylic - Semi-Gloss.
 - b. Moore: ULTRA SPEC® HP D.T.M. Acrylic - Semi-Gloss, HP29.
 - c. PPG Paints: BREAK-THROUGH!® 50 Interior/Exterior WB Acrylic - Satin.
 - d. PPG Paints: PITT-TECH® Interior/Exterior Primer/Finish DTM Industrial Enamel – Semi-Gloss.
 - e. S-W: Pro Industrial™ DTM Acrylic Interior-Exterior - Semi-Gloss, #B66 Series.
4. Exterior Waterborne Semi-Gloss Enamel for use over a primer and undercoat on interior ferrous surfaces.
- a. DV: Finium DTM-AT Acrylic - Semi-Gloss.
 - b. Moore: ULTRA SPEC® HP D.T.M. Acrylic - Semi-Gloss, HP29.
 - c. PPG Paints: BREAK-THROUGH!® 50 Interior/Exterior WB Acrylic - Satin.
PPG Paints: PITT-TECH® Interior/Exterior Primer/Finish DTM Industrial Enamel – Semi-Gloss.
 - d. S-W: Pro Industrial™ DTM Acrylic Interior-Exterior - Semi-Gloss, #B66 Series.

G. System FM-51 for application on Interior Ferrous Metal—Semi-Gloss:

- 1. Semi-Gloss Waterborne Alkyd Enamel Finish: Two (2) coats over primer with total dry film thickness not less than 2.5 mils.
- 2. Acrylic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal on the interior under waterborne semi-gloss enamels:
 - a. DV: Vers-Acryl 300 Acrylic DTM Primer.
 - b. Moore: ULTRA SPEC® HP Acrylic Metal Primer, HP04.
 - c. PPG Paints: SEAL GRIP® Interior/Exterior Synthetic Stain Killing Primer.
 - d. S-W: Pro Industrial™ Pro-Cryl® Universal Primer, B66 Series.
 - e. Or equal, if and as specifically approved by Architect by Addendum during bidding period.
- 3. Interior Enamel Undercoat: Ready-mixed enamel for use as an undercoat over a primer on ferrous metal under interior semi-gloss waterborne enamel:
 - a. DV: Vers-Acryl 222 Acrylic Maintenance Finish - Semi-Gloss.
 - b. Moore: CORONADO® SUPER KOTE 5000® Waterborne Acrylic- Alkyd – Semi-Gloss, 204.
 - c. PPG Paints: SPEEDHIDE® Interior/Exterior WB Alkyd - Semi-Gloss.
 - d. S-W: Pro Industrial™ Waterbased Alkyd Urethane - Semi-Gloss, B53 Series.
 - e. Or equal, if and as specifically approved by Architect by Addendum during bidding period.
- 4. Exterior Waterborne Semi-Gloss Enamel for use over a primer and undercoat on interior ferrous surfaces:
 - a. DV: Vers-Acryl 222 Acrylic Maintenance Finish - Semi-Gloss.
 - b. Moore: CORONADO® SUPER KOTE 5000® Waterborne Acrylic- Alkyd – Semi-Gloss, 204.
 - c. PPG Paints: SPEEDHIDE® Interior/Exterior WB Alkyd - Semi-Gloss.
 - d. S-W: Pro Industrial™ Waterbased Alkyd Urethane - Semi-Gloss, B53 Series.

- e. Or equal, if and as specifically approved by Architect by Addendum during bidding period.

H. System FM-61 for application on Interior Ferrous Metal—Clear-Coat Aluminum Paint/Finish (Spray-Applied System):

1. Semi-Gloss Alkyd (Aluminum) Enamel Finish: Two (2) coats over primer with total dry film thickness not less than 2.5 mils.
2. Acrylic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal on the interior under waterborne semi-gloss enamels:
 - a. DV: Vers-Acrl 300 Acrylic DTM Primer.
 - b. PPG Paints: PITT-TECH® Plus Interior/Exterior DTM Industrial Primer.
 - c. S-W: Pro Industrial™ Pro-Cryl® Universal Primer, B66 Series.
 - d. Or equal, if and as specifically approved by Architect by Addendum during bidding period.
3. Interior Enamel Intermediate Coat: Ready-mixed enamel for use as an undercoat over a primer on ferrous metal under an interior semi-gloss alkyd enamel:
 - a. DV: Endura-Zinc 703 Bright Cold Galvanizing Primer Finish - Low Sheen.
 - b. PPG Paints: SPEEDHIDE® Interior/Exterior Aluminum Paint - Semi-Gloss (Aluminum color).
 - c. S-W: Bond-Plex® Waterbased Acrylic Coating - Aluminum, B71 Series.
 - d. Or equal, if and as specifically approved by Architect by Addendum during bidding period.
4. Interior Alkyd Semi-Gloss Enamel for use over a primer and undercoat on interior ferrous surfaces:
 - a. DV: Endura-Zinc 703 Bright Cold Galvanizing Primer Finish - Low Sheen.
 - b. PPG Paints: SPEEDHIDE® Interior/Exterior Aluminum Paint - Semi-Gloss (Aluminum color).
 - c. S-W: Bond-Plex® Waterbased Acrylic Coating - Aluminum, B71 Series.
 - d. Or equal, if and as specifically approved by Architect by Addendum during bidding period.

I. System FM-111 for application on Interior Ferrous Metal—Gloss:

1. Gloss Waterborne Enamel Finish: Two (2) coats over primer with total dry film thickness not less than 2.5 mils.
2. Acrylic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal on the interior under waterborne gloss enamels.
 - a. DV: Vers-Acrl 303 Acrylic DTM Primer/Finish.
 - b. Moore: ULTRA SPEC® HP Acrylic Metal Primer, HP04.
 - c. PPG Paints: PITT-TECH® Interior-Exterior Primer/Finish DTM Industrial Enamel.
 - d. S-W: Pro Industrial™ Pro-Cryl® Universal Primer, B66 Series.
3. Interior Enamel Undercoat: Ready-mixed enamel for use as an undercoat over a primer on ferrous metal under interior gloss waterborne enamel.
 - a. DV: Finium DTM-AT Acrylic - Gloss.
 - b. Moore: ULTRA SPEC® HP D.T.M. Acrylic - Gloss, HP28.
 - c. PPG Paints: BREAK-THROUGH!® Ultra Durable Waterborne Acrylic Enamel –

- Gloss.
 - d. PPG Paints: PITT-TECH® Interior/Exterior Acrylic DTM Industrial Enamel - Gloss.
 - e. S-W: Pro Industrial™ DTM Acrylic Interior-Exterior - Gloss, #B66 Series.
4. Exterior Waterborne Gloss Enamel for use over a primer and undercoat on interior ferrous surfaces.
- a. DV: Finium DTM-AT Acrylic - Gloss.
 - b. Moore: ULTRA SPEC® HP D.T.M. Acrylic - Gloss, HP28.
 - c. PPG Paints: BREAK-THROUGH!® Ultra Durable Waterborne Acrylic Enamel – Gloss.
 - d. PPG Paints: PITT-TECH® Interior-Exterior Acrylic DTM Industrial Enamel - Gloss.
 - e. S-W: Pro Industrial™ DTM Acrylic Interior-Exterior - Gloss, #B66 Series.

J. System GDW-21 for application on Interior Gypsum Drywall / Plaster Ceilings—Flat except Shower areas:

1. Flat Latex Finish: Two (2) finish coats over primer.
2. Latex-Based Interior White Primer: Latex-based primer coating used on interior gypsum drywall under a flat latex paint.
 - a. DV: Zero Plus Interior Zero VOC* Latex Primer.
 - b. DV: OmniPrep Universal Interior Primer.
 - c. Moore: SUPER HIDE® Zero VOC Interior Latex Primer, 354.
 - d. Moore: FRESH START® Multi-Purpose Latex Primer, N023.
 - e. PPG Paints: PURE PERFORMANCE® Zero VOC Interior Latex Primer.
 - f. S-W: Harmony® Interior Latex Primer, B11 Series.
3. Flat Latex Paint: Latex-based paint for use as a flat finish over prime-coated gypsum drywall.
 - a. DV: Zero Plus Interior Zero VOC* Latex - Flat.
 - b. DV: Avalon Ultra Premium Interior Latex Enamel – Flat/Matte.
 - c. Moore: SUPER HIDE® Zero VOC Interior - Flat, 355.
 - d. PPG Paints: PPG PERFORMANCE® Flat Interior Latex.
 - e. PPG Paints: PURE PERFORMANCE® Interior Latex - Flat.
 - [Note to Specifier: Equivalent to Sherwin Williams “Harmony”.]
 - f. S-W: Harmony® Interior Acrylic – Flat, B5 Series.

K. System GDW-31 for application on Interior Gypsum Drywall / Plaster—Eggshell, Typical Walls:

1. Eggshell Latex Enamel Finish: Two (2) finish coats over primer.
2. Latex-Based Interior White Primer: Latex-based primer coating used on interior gypsum drywall under an eggshell latex paint.
 - a. DV: Zero Plus Interior Zero VOC* Latex Primer.
 - b. DV: OmniPrep Universal Interior Primer.
 - c. Moore: SUPER HIDE® Zero VOC Interior Latex Primer, 354.
 - d. Moore: FRESH START® Multi-Purpose Latex Primer, N023.
 - e. PPG Paints: PURE PERFORMANCE® Interior Latex Primer.
 - f. S-W: Harmony® Interior Latex Primer, B11 Series.
3. Eggshell Latex Enamel: Latex-based paint for use as an eggshell finish over prime-coated gypsum drywall.

- a. DV: Zero Plus Interior Zero VOC* - Latex - Eggshell.
- b. DV: Avalon Ultra Premium Interior Latex Enamel – Eggshell.
- c. Moore: SUPER HIDE® Zero VOC Interior - Eggshell, 357.
- d. PPG Paints: PURE PERFORMANCE® Interior Latex - Eggshell.
- e. .
- f. S-W: Harmony® Interior Acrylic – Eg-Shel, B9 Series.

L. System GDW-41 for application on Interior Gypsum Drywall / Plaster—Semi-Gloss (Restrooms, Mechanical Rooms, Electrical Rooms, Janitor’s Closets, or Other Wet Areas):

- 1. Semi-Gloss Latex Finish: Two (2) finish coats over primer.
- 2. Latex-Based Interior White Primer: Latex-based primer coating used on interior gypsum drywall under a semi-gloss latex paint.

- a. DV: Zero Plus Interior Zero VOC* Latex Primer.
- b. DV: OmniPrep Universal Interior Primer.
- c. Moore: SUPER HIDE® Zero VOC Interior Latex Primer, 354.
- d. Moore: FRESH START® Multi-Purpose Latex Primer, N023.
- e. PPG Paints: PURE PERFORMANCE® Interior Latex Primer.
- f. S-W: Harmony® Interior Latex Primer, B11 Series.

- 3. Semi-Gloss Latex Finish:

- a. DV: Zero Plus Interior Zero VOC* Latex – Semi Gloss.
- b. DV: Avalon Ultra Premium Interior Latex Enamel – Semi Gloss.
- c. Moore: SUPER HIDE® Zero VOC Latex - Semi-Gloss, 358.
- d. PPG Paints: PURE PERFORMANCE® Interior Latex - Semi-Gloss.
- e. S-W: Harmony® Interior Acrylic – Semi-Gloss, B10 Series.

END OF SECTION 09 91 23

SECTION 09 96 13 - FIBER-REINFORCED ABRASION RESISTANT COATINGS

1. PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and application of high-performance coating systems on the following substrates:
 - 1. Interior Substrates.
 - a. Concrete, surfaces.
 - b. Concrete masonry units (CMU).
 - c. Gypsum board.
- B. Related Sections include the following:
 - 1. Section 09 91 23 "Interior Painting" for general field painting.
 - 2. Section 09 65 19 "Resilient Tile Flooring" for integrated floor systems.
 - 3. Section 09 67 13 "Broadcast-Applied Decorative Flake Resinous Flooring" for integrated floor systems.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of finish-coat product indicated.
- C. Samples for Verification: For each type of coating system and in each color and gloss of finish coat indicated:
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
 - 5. Submit samples for the Architect's review of color and texture only.
- D. Product List: For each product indicated. Cross-reference products to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who employs only persons trained and approved by special coatings manufacturer for applying special coatings systems indicated.

1. Qualifications of installers for special coatings system shall not be less than five years of experience installing specified items. Special coatings installer shall be manufacturer approved and have performed at least ten similar installations.
 2. Special Coatings System Installers must be pre-approved by the Architect. Subject to the requirements of the specifications and approval of the manufacturer, pre-approved installers are listed in paragraph 2.1 of this Section.
- B. Single-Source Responsibility: Provide primers and undercoat material produced by the same manufacturer as the finish coats for each type of coating. Use only thinners recommended by the manufacturer and only within recommended limits.
- C. Mockups: Apply benchmark samples of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq.m).
 - b. Other Items: Architect will designate items or areas required.
 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 3. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 60° F (16 deg C).
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 60 and 80° F (16 and 27° C), or follow manufacturer's written instructions if more stringent.
- B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces, or follow manufacturer's written instructions if more stringent.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

2. PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 1. Tnemec Company, Inc. (Basis of Design)
 2. Sika Corporation.
 3. Or equal, if and as specifically approved by Architect.
- B. Material Compatibility:
 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. Provide products of same manufacturer for each coat in a coating system.
- C. Material Quality: Provide the highest grade of the various coatings as regularly manufactured by acceptable coating manufacturers. Materials not displaying manufacturer's identification as a best-grade product will not be acceptable.

2.2 FIBER-REINFORCED ABRASION RESISTANT COATINGS SCHEDULE

<u>LOCATION</u>	<u>SHEEN</u>	<u>COATINGS SYSTEM</u>
Interior Concrete (EPC-Epoxy)	Gloss	EPC-1
Interior Gypsum Drywall (FRE-Epoxy)	Gloss	FRE-1

2.3 PRIMERS AND SEALERS

- A. Primer/Sealers: Provide the manufacturer's recommended factory-formulated primer/sealers that are compatible with the substrate and finish materials indicated.

2.4 INTERIOR FINISH COAT MATERIALS

- A. Interior Finish-Coat Materials: Provide the manufacturer's recommended factory-formulated, interior, finish-coat materials.
 1. Where undercoats or other conditions show through final coat, apply additional coats until the cured film is of uniform coating finish, color and appearance.
- B. Products: Subject to compliance with requirements, provide the following coating systems for substrates indicated or equal by one of the approved manufacturers.
 1. System EPC-(1) for application on Interior Concrete Masonry and Cast-in-Place Concrete:

- a. Surface Prep: Allow concrete and mortar to cure 28 days prior to beginning special coatings work. Completely remove all mortar spills, protrusions, dirt and other contaminants. Provide clean, dry, bare concrete surface, of a uniform surface profile, ready for application of new finish coatings. Abrasive blast, mechanically abrade, or grind the walls to create a uniformed surface profile similar to an ICRI CSP2-4.
 - b. Prime Coat over clean, dry, bare concrete:
 - 1) Tnemec Series 201 Epoxoprime, Modified Polyamine Epoxy at 6 – 8 mils. Brush material into hard-to-reach areas. Backroll entire surface to create a pinhole free coating. Fill any surface voids, holes or depression with Tnemec Series 215 Surfacing Epoxy.
 - c. Body Coat:
 - 1) Tnemec Series 270 Stranlok Fiberglass Reinforced Epoxy at 25 – 40 mils. Spray apply material per manufacturer's instructions. After application of body coat, sand surface to remove protruding fiberglass.
 - d. Finish Coat:
 - 1) Tnemec Series 280 Tnemec-Glaze with Anti-Microbial additive at 6 – 8 mils. All surfaces shall be uniform in appearance.
 - e. Color:
 - 1) Refer to Finishes Legend
2. System FRE-1 for application on Interior Gypsum Board Walls and Ceilings
- a. Surface Prep: Remove sanded dust and provide clean, dry surface, of a uniform surface profile, ready for application of new finish coatings.
 - b. Prime Coat over clean, dry gypsum board:
 - 1) Tnemec Series 201 Epoxoprime, Modified Polyamine Epoxy at 6 – 8 mils (267 to 325 sf/gal). Brush material into hard-to-reach areas. Backroll entire surface to create a pinhole free coating.
 - c. Body Coat:
 - 1) Tnemec Series 273 Stranlok ML: When primer is tacky, apply Tnemec Series 273 Stranlok ML at 8 – 10 mils and embed Series 273 fiberglass mat into wet resin. Use smoothing tool to force mat into wet resin. Reapply Series 273 Stranlok ML to completely saturate/encapsulate the fiberglass mat. Sand after coating has dried 8 – 24 hours.
 - d. Finish Coat:
 - 1) Tnemec Series 280 Tnemec-Glaze with Anti-Microbial additive at 8 – 10 mils. If mat material is still visible, apply a second finish coat. All surfaces shall be uniform in appearance and seams shall be hidden.
 - e. Color:

- 1) Refer to Finishes Legend

3. PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Gypsum Board: 12 percent.
 - d. Or manufacturer's written requirements if more stringent.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 3. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 4. Coating application indicates acceptance of surfaces and conditions.
 5. Notify the Architect of problems anticipated using the coatings specified over substrates primed by others.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
- C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- E. CMU Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

- F. Material Preparation: Carefully mix and prepare materials according to the coating manufacturer's directions.

1. Maintain containers used in mixing and application of coatings according to the manufacturer's directions.
2. Stir materials before applying to produce a mixture of uniform density; stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain the coating material before using.
3. Use only the type of thinners approved by the manufacturer and only within recommended limits.

3.3 APPLICATION

- A. General: Apply high-performance coatings according to manufacturer's written instructions.

1. Use applicators and techniques suited for coating and substrate indicated.
2. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
3. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
4. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.
5. Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
6. Coating colors, surface treatments, and finishes are indicated in the Schedules.
7. Provide finish coats compatible with the primers used.
8. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Where sanding is required, according to the manufacturer's directions, sand between applications to produce a smooth, even surface.
9. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, conveyor covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 - a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces.
 - b. Coat the back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - c. Omit primer on metal surfaces that have been shop-primed and touch-up painted.

3.4 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:

1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with specified requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces

coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.
- E. Provide "Wet Paint" signs to protect newly coated finishes.

3.6 FIBER-REINFORCED ABRASION RESISTANT COATINGS ASSIGNMENT SCHEDULE

- A. Refer to the drawings, room finish schedules and notes for paint requirements. Architect shall approve all "match adjacent surfaces" colors before painting begins.
- B. Interior metal windows, doors and frames within walls scheduled to be painted with High-Performance Specialty Wall Coatings. Match color of adjacent surface.
- C. Access doors and panels within walls scheduled to be painted with High-Performance Specialty Coatings. Match color of adjacent surface.

END OF SECTION 09 96 13

SECTION 10 21 19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-plastic toilet compartments configured as toilet enclosures.
- B. Related Requirements:
 - 1. Section 10 28 00 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show locations of floor drains.
 - 5. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.
- C. Samples for Initial Selection: For each type of toilet compartment material indicated.
 - 1. Include Samples of hardware and accessories involving material and color selection.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.
 - 2. Each type of hardware and accessory.

- E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents and source.
 - 1. Door Hinges: One hinge(s) with associated fasteners.
 - 2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
 - 3. Door Bumper: One bumper(s) with associated fasteners.
 - 4. Door Pull: One door pull(s) with associated fasteners.
 - 5. Fasteners: Ten fasteners of each size and type.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286. Verify accessibility requirements of authorities having jurisdiction. Some projects may require compliance with multiple accessibility regulations.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASI Group, American Specialties, Inc—Global Partitions.
 - 2. Bradley Corporation; Mills Partitions.
 - 3. Hadrian Manufacturing Inc.
 - 4. Scranton Products, Inc.
 - 5. Or equal, if and as specifically approved by Architect.

- B. Toilet-Enclosure Style: Floor and wall anchored as indicated on drawings.
- C. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.
 - 1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 - 2. Heat-Sink Strip: Manufacturer's standard continuous, stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 - 3. Color and Pattern: As selected by Architect from manufacturer's full range.
- D. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.
 - 1. Polymer Color and Pattern: Stainless Steel
- E. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, stainless steel.
 - 2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.
- F. Overhead Cross Bracing for Ceiling-Hung Units: As recommended by manufacturer and fabricated from solid polymer.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
 - 1. Hinges: Manufacturer's minimum 0.062-inch- (1.59-mm-) thick stainless-steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through-bolts.
 - 2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
 - 3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
 - 4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
 - 5. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with anti-grip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
- C. Brass Castings: ASTM B 584.
- D. Brass Extrusions: ASTM B 455.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- F. Stainless-Steel Castings: ASTM A 743/A 743M.
- G. Zamac: ASTM B 86, commercial zinc-alloy die castings.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-and-Wall-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
- B. Maintain 3/8 inch to 1/2 inch (9mm to 13mm) space between wall and panels and between wall and end pilasters.

- C. Floor-and-Wall-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.
- D. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 19

SECTION 10 26 00 – WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following types of wall surface protection systems:
 - 1. Wall/Corner surface protection products.

1.3 SUBMITTALS

- A. Product data for each wall surface protection system component and installation accessory.
- B. Samples for initial selection by the Architect from the manufacturers full range of colors and textures.

1.4 QUALITY ASSURANCE

- A. Fire Performance Characteristics: ASTM E 84. Flame spread of 25 or less and smoke developed of 450 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original factory wrappings, clearly labeled with identification of manufacturer.
- B. Store wall surface protection materials inside a well-ventilated area protected from weather and soiling.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Do not install wall surface protection system components until the space is enclosed and the ambient temperature is not less than 70 deg F for not less than 72 hours prior to installation.

1.7 MAINTENANCE

- A. Maintenance Instructions: Provide the manufacturer's instructions for maintenance of installed work.
- B. Replacement Materials: After completion of work, deliver not less than 2 percent of each type of wall surface protection materials and components.

2. PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. (ONLINE) The Corner Guard Store (www.thecornergaurdstore.com)
 2. The C/S Group
 3. Institutional Products Corporation
 4. Pawling Corporation
 5. Or equal, if and as specifically approved by Architect.

2.2 MATERIALS

- A. Stainless Steel: Type 304, stainless steel plate, minimum 0.06 inch (1.5 mm), No. 4 satin directional finish.
1. Surface Mounted Stainless Steel Corner Guards: Provide manufacturer's standard paper-covered satin finish, 0.059 inch (1.5 mm) minimum, stainless steel sheet corner guards, height as indicated. Provide 90-degree turn, unless otherwise indicated, and formed edges.
 - a. **CG-1**, C/S Group (Acrovyn) CO, Corner guard or equal.
 - 1) Profile: 90 degree.
 - 2) Corner Radius: 3/16 inch (4.8 mm).
 - 3) Leg Size: 1" inch legs.
 - 4) Material Gauge: 16 Stainless Steel.
 - 5) Finish: Brushed/Satin Stainless Steel.
 - 6) Corner Guard Height: Full Height, Floor to Head of Opening.
 - 7) Mounting Height: Bottom of Corner Guard to be installed at top of finished floor / Bottom of Corner Guard to be installed at top of integral wall base.
 - 8) Mounting Method: Countersunk stainless steel screws with mounting holes 8 inches (200 mm) on center.

Mounting Height: Bottom of Corner Guard to be installed at top of finished floor.

2.3 INSTALLATION

- A. Prior to installation, clean substrate to remove dust, debris, and loose particles.
- B. Install wall surface protection unit's plumb, level, and true to line without distortions. Do not use materials with chips, cracks, stains, or other defects that might be visible in the finished work.
- C. Install in strict accordance with the manufacturer's instructions.

2.4 CLEANING

- A. Immediately upon completion of installation, clean wall surface protection systems using

methods and materials recommended by manufacturer. Remove excess adhesive. Leave area of installation in clean, neat condition.

END OF SECTION

SECTION 10 28 00 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Surface-Mounted Multi-Roll Toilet Tissue Dispenser.
 - 2. Surface-mounted Sanitary Napkin Disposal.
 - 3. Grab Bar: Satin-Finish Stainless Steel, 1-1/2" (38 mm) diameter.
 - 4. Clothes (Utility) Hook.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

- B. Manufacturer's Standard Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective automated hand dryer components and labor within specified warranty period.
 - 1. Warranty Period: One (1) year limited for labor and five (5) years for parts.
- B. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: **15** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick. Stainless Steel Channel Frame at Top and Bottom.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 SURFACE-MOUNTED MULTI-ROLL TOILET TISSUE DISPENSER (TTD-1)

- A. Georgia-Pacific Compact Quad Vertical Four Roll Coreless Tissue Dispenser, Model # 56746, Stainless Finish.

2.4 STAINLESS STEEL SANITARY NAPKIN DISPOSAL (SND-1)

- A. Bobrick Washroom Equipment, Inc., ConturaSeries® Surface-mounted Sanitary Napkin Disposal, Product #B-270.
- B. Finish: Satin-Finish Type #304 Stainless Steel. Surface-mounted Sanitary Napkin Disposal shall be type 304 stainless steel with all welded construction, exposed surfaces shall have satin finish. Cover shall be drawn, one-piece, seamless construction and secured to container with a full-length stainless steel piano hinge. Container shall have integral finger depression or opening cover. Install per manufacturer's written instructions.

2.5 GRAB BARS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. Bradley Corporation
 - 3. Foundations Worldwide, Inc.
 - 4. Or equal if and as specifically approved by Architect
- C. Bobrick Washroom Equipment, Inc., Stainless Steel, 1-1/2" (38 mm) diameter Grab Bar with 2" Snap End Flange, Product #B-6806.99.
 - 1. 18-gauge, 1-1/2" (38 mm) diameter grab bar. Clearance between the grab bar and wall shall be 1-1/2" (38 mm). Concealed mounting flanges shall be 1/8" (3 mm) thick stainless steel plate, 2" x 3-1/8" (50 x 80 mm), and equipped with two screw holes for attachment to wall. Flange covers shall be 22 gauge (0.8 mm), 3-1/4" (85 mm) diameter x 1/2" (13 mm) deep, and shall snap over mounting flange to conceal mounting screws and/or WingIt fasteners. Ends of grab bar shall pass through concealed mounting flanges and be heliarc welded to form one structural unit. Grab bar shall comply with barrier-free accessibility guidelines (including ADAAG in the U.S.A.) for structural strength. Finish: Satin-Finish Type #304 Stainless Steel.
 - 2. 18" Grab Bar: #B-6806.99x18.
 - 3. 36" Grab Bar: #B-6806.99x36.
 - 4. 42" Grab Bar: #B-6806.99x42.

2.6 CLOTHES (UTILITY) HOOKS (CH-1)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. Bradley Corporation
 - 3. Foundations Worldwide, Inc.
 - 4. **Or equal if and as specifically approved by Architect**
- C. Bobrick Washroom Equipment, Inc., Model #B-2116 Single Hook.
 - 1. Heavy-duty clothes hook with concealed mounting shall be one-piece brass casting with satin nickel-plated finish. Hook shall be secured to a concealed wall plate with three stainless steel setscrews. Hook shall withstand 300lb downward pull when properly installed. Provide concealed backing as required.

PART III – EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions

END OF SECTION 10 28 00

SECTION 22 05 00 - BASIC PLUMBING REQUIREMENTS

1. GENERAL

1.1 SECTION INCLUDES

- A. This section describes Basic Plumbing Requirements required to provide for a complete installation of all plumbing systems for this project. This section shall apply to all other Division 22 specification sections as well as all work shown on the drawings.
- B. Plumbing demolition requirements.
- C. It is the intent of the Plumbing Division of the Specifications that all plumbing work specified herein be coordinated as required with the work of all other Divisions of the Specifications and Drawings so that all installations operate as designed.
- D. All systems shall be completely assembled, tested, adjusted and demonstrated to be ready for operation to the satisfaction of the Owner's representative.
- E. The Contractor shall note that, in some cases, piping as shown on the Drawings provide general location and routing information only. The Contractor shall be responsible for providing interference-free systems with proper clearance to facilities and equipment.
- F. Where the word "provide" is used, it shall mean "furnish and install" unless otherwise noted or specified.
- G. Note that the words "mechanical" and "plumbing" are used interchangeably throughout the Division 22 and 23 specification sections.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section and all other sections of Division 22.

1.3 DESCRIPTION OF WORK

- A. The work included under this section consists of providing all labor, materials, supervision, and construction procedures necessary for the installation of the complete plumbing systems required by these specifications and/or shown on the drawings of the contract.
- B. The Contract Drawings are shown in part diagrammatic intended to convey the scope of work, indicating the intended general arrangement of equipment, piping fixtures, etc. The Contractor shall follow the drawings in laying out work and verify clearances for the installation of the materials and equipment based on the dimensions of actual equipment furnished. Whenever a question exists as to the exact intended location of outlets or equipment, obtain instructions from the Architect/Engineer before proceeding with the work.

1.4 QUESTIONS OF INTERPRETATION

- A. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect/Engineer for clarification. Any definitive interpretation or clarification of the contract documents will be published by addenda, properly issued to each person holding documents, prior to the bid date. Verbal interpretation or explanation not issued in the form of an addendum shall not be considered part of the bidding documents. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.
- B. The Architect/Engineer shall be the sole judge regarding interpretations of conflicts within contract documents.

1.5 CONTRACT DOCUMENT DISCREPANCIES

- A. If any ambiguities should appear in the contract documents, the Contractor shall request clarification from the Architect/Engineer before proceeding with the work. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a manner satisfactory to the Architect/Engineer. Should a conflict occur within the contract documents, the Contractor is deemed to have estimated the more expensive way of doing the work unless a written clarification from the Architect/Engineer was requested and obtained before submission of bid.
- B. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of three-dimensional objects. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies should be identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
- C. The Contractor shall follow the drawings in laying out work and verify clearances for the installation of the materials and equipment based on the dimensions of actual equipment furnished. Whenever a question exists as to the exact intended location of materials or equipment, obtain instructions from the Architect/Engineer before proceeding with the work.
- D. If there is a conflict between manufacturer's recommendations and the Contract Documents, the manufacturer's recommendations shall govern with no additional cost to the Owner.

1.6 PERMITS

- A. All permits, fees, licenses, etc. required for this project shall be obtained by the Contractor.

1.7 QUALITY ASSURANCE

- A. Installers shall have at least 2 years of successful installation experience on projects with mechanical installation work similar to that required by the project. All equipment and materials shall be installed in a neat and workmanlike manner and shall be aligned, leveled, and adjusted for satisfactory operation, unless noted otherwise in other mechanical sections.

- B. Manufacturer of equipment and materials must be regularly engaged in the manufacture of the specified equipment and material with similar construction and capacities and whose products have been in satisfactory use in similar service for not less than five (5) years, unless noted otherwise in other Mechanical Sections.
- C. Qualify welding processes and operators for structural steel according to AWS D1.1. "Structural Welding Code - Steel.
- D. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
- E. Comply with provisions of ASME B31 Series "Code for Pressure Piping", including all addenda.
- F. Contractor signed welder certificate(s) shall be submitted. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current. A record shall be maintained on the job site showing the date and results of qualification tests for each welder employed on the job. One certified copy of the qualification test for each welder so employed shall be furnished to the Owner's representative.
- G. For all the refrigerant work/service required by this project, all refrigerant technicians shall be EPA/ASHRAE 34 certified for corresponding classification type I, II, III and/or IV.

1.8 REFERENCES

- A. The design, manufacture, testing, and method of installation of all equipment and materials furnished under the requirements of this specification shall conform to the following as applicable:
 - 1. Safety and Health Regulations for Construction.
 - 2. Occupational Safety and Health Standards, National Consensus Standards and Established Federal Standards.
 - 3. ABMA - American Boiler Manufacturers Association.
 - 4. ACCA - Air Conditioning Contractors of America.
 - 5. ACGIH - American Conference of Governmental Industrial Hygienists.
 - 6. ADC - Air Diffusion Council.
 - 7. AGA - American Gas Association.
 - 8. AIHA - American Industrial Hygiene Association.
 - 9. AMCA - Air Movement and Control Association.
 - 10. ANSI - American National Standards Institute.
 - 11. ARI - Air-Conditioning and Refrigeration Institute.
 - 12. ASA - Acoustical Society of American.
 - 13. ASHRAE - American Society of Heating, Refrigerating, and Air-Conditioning Engineers.
 - 14. ASME - The American Society of Mechanical Engineers.
 - 15. ASTM - American Society of Testing and Materials.
 - 16. BOCA – Building Officials and Code Administrators International.
 - 17. CABO – Council of American Building Officials.
 - 18. CAGI - Compressed Air and Gas Institute.
 - 19. CTI - Cooling Tower Institute.
 - 20. EJMA - Expansion Joint Manufacturers Association.
 - 21. ETL - Engineering Tests Laboratory.
 - 22. HEI - Heat Exchange Institute.
 - 23. HI - Hydraulic Institute.
 - 24. HYD I - Hydronics Institute.
 - 25. IAPMO – International Association of Plumbing and Mechanical Officials.

26. ICBO - International Conference of Building Officials.
27. ICC – International Code Council.
28. NEBB - National Environmental Balancing Bureau.
29. NEC - National Electrical Code.
30. NEMA - National Electrical Manufacturers Association.
31. NFPA - National Fire Protection Association.
32. NSF - National Sanitation Foundation.
33. SAE - Society of Automatic Engineers.
34. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
35. TEMA - Tubular Exchanger Manufacturers Association.
36. UL - Underwriters Laboratories, Inc.
37. International Plumbing Code.
38. International Mechanical Code.
39. Other governing, state, and local codes that apply.

1.9 SUBMITTALS

- A. General: Follow the procedures specified in Division 1 Sections "General Conditions" and "Special Conditions".
- B. Shop drawings shall include the minimum following information as applies. Additional specific information required is outlined in other Mechanical Sections.
 1. Certified performance and data with system operating conditions indicated. All coil, fan, and pump performance data shall be computer generated.
 2. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicating, weights (shipping, installed, and operating), furnished specialties and accessories; and installation and start-up instructions.
 3. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loading, required clearances, and methods of assembly of components.
 4. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to electrical equipment. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of electrical equipment and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
 5. Maintenance Data: Submit maintenance data and parts list for each mechanical equipment, control and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 1.
- C. Provide separate shop drawing submittals for the following items:
 1. Section 22 05 00 – Basic Plumbing Requirements:
 - a. Plumbing Permits
 - b. Plumbing Licenses
 - c. EPA/ASHRAE 34 Refrigeration Certification (as required)
 - d. Welding certificates
 - e. Warranties
 - f. As-built documents
 - g. Pipe pressure test logs
 - h. Operation and maintenance manuals (electronic copies integrated into BMS)
 - i. Close-out / walk-through documentation

- j. Training seminar documentation
- 2. Section 22 05 19 – Plumbing Meters and Gauges:
 - a. Pressure gauges
 - b. Thermometers
 - c. Pressure/temperature test plugs
- 3. Section 22 05 29 – Plumbing Hangers and Supports:
 - a. Pipe supports, anchors, sleeves, and hangers
 - b. Equipment curbs, supports, and hangers
 - c. Fire sealants
- 4. Section 22 05 53 – Plumbing Identification:
 - a. Plumbing identification materials
 - b. Valve schedule
- 5. Section 22 05 93 – Plumbing Testing and Balancing:
 - a. Pre-balancing conference meeting notes
 - b. Pre-balancing field deficiency report
 - c. Draft TAB report
 - d. Final TAB report
- 6. Section 22 07 19 – Plumbing Piping Insulation:
 - a. Pipe Insulation materials and insulation schedule
- 7. Section 22 10 00 – Plumbing Piping:
 - a. Installer factory training and certifications for laboratory waste and vent piping
 - b. Plumbing piping material and fitting schedule
 - c. Plumbing valve material and schedule
 - d. Calibrated balance valves
 - e. Plumbing pipe accessories
 - f. Plumbing hydrostatic test report(s)
 - g. Domestic water sample test report(s)
- 8. Section 22 11 19 – Plumbing Specialties:
 - a. Plumbing specialties, cleanouts, plumbing fixture carriers, etc.
- 9. Section 22 21 23 – Plumbing Pumps:
 - a. All scheduled plumbing pumps
- 10. Section 22 30 00 – Plumbing Equipment:

- a. All scheduled plumbing equipment

11. Section 22 40 00 – Plumbing Fixtures:

- a. All scheduled plumbing fixtures and accessories

1.10 SUBSTITUTES

- A. All proposals shall be based on providing and installing the materials or items of equipment which are hereinafter specified.
- B. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing. Associated mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are to be increased accordingly, but all recommended manufacturer clearances, etc., are to be maintained within the allotted mechanical spaces. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.
- C. Where the terms "or equivalent" is used, the Contractor may substitute alternate equipment, materials, etc. subject to review by the Architect/Engineer and the Owner's representative during the submittal phase of the project.
- D. Where the term "or approved equivalent" is used, the Contractor may not substitute alternate equipment, materials, etc. unless requesting approval at least ten (10) days before the bid date. Notifications of any such approvals by the Architect/Engineer shall only be made in writing by Addendum.
- E. Where the term "no equivalent" is used, the Contractor must provide the specified or scheduled equipment, materials, etc.
- F. Final determination regarding substitutions shall be by the Architect/Engineer.

1.11 WARRANTY

- A. Refer to the General Conditions section of this Specification for general warranty requirements and information. Additional warranty requirements are specified in subsequent Mechanical Sections.

1.12 CLOSE OUT AND OPERATION INSTRUCTIONS

- A. Operate each system and item of equipment in a test run of appropriate duration, but no less than 7 days, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance.
- B. Any system placed in temporary operation for testing or for the convenience of the Contractor during construction shall be properly maintained and operated by the Contractor.
- C. All systems shall be protected against freezing, flooding, corrosion or other forms of damage prior to acceptance by the Owner.

- D. Material or equipment damaged, shown to be defective or not in accordance with the Specifications shall be repaired or replaced to the satisfaction of the Owner's representative.
- E. All tests shall be made after notification to and in the presence of the Owner's representative.
- F. Before starting up any system, each piece of equipment comprising any part of the system shall be checked for proper lubrication and any other condition which may cause damage to the equipment or endanger personnel.
- G. After systems have been demonstrated to be satisfactory for 7 consecutive days and ready for permanent operation, all permanent pipe line strainers shall be cleaned, valve and packings properly adjusted, lubrication checked and replenished if required. Temporary piping, etc. shall be removed and openings restored in a permanent manner acceptable to the Owner's representative.
- H. Conduct a walk-through instruction seminar for the Owner's personnel pertaining to the continued operation and maintenance of mechanical equipment and systems. Explain the identification system, maintenance requirements, operational diagrams, temperature control provisions, sequencing requirements, security, safety, efficiency and similar features of the systems. Walk through must be documented as to those attending and subjects covered. Walk through document(s) shall be signed and dated by the contractor's representative and the owner's representative.
 - 1. Provide instruction seminar, minimum 1 hour each, for each of the following items:
Domestic Water Heater DWH-1, and Thermal Mixing Valve TMV-1
- I. At the time of substantial project completion, turn over the prime responsibility for operation of the plumbing equipment and systems to the Owner's operating personnel. Until the time of final acceptance, provide full time operating personnel, who are completely familiar with the work, to consult with and continue training the Owner's personnel.
 - 1. If any systems are operated prior to substantial completion, the contractor shall perform all necessary preventative maintenance according to all manufacturer recommendations.

1.13 RECORD DOCUMENTS

- A. Prepare as-built documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in above, indicate the following installed conditions:
 - 1. All plumbing systems as described in the Specifications and/or shown on the drawings.
 - 2. The Plumbing Contractor shall provide the Owner with as-built drawings for mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 22 Section "Plumbing Identification." Indicate actual inverts and horizontal locations of underground piping.
 - 3. Equipment/material locations (exposed and concealed), dimensioned from prominent building lines.
 - 4. All items must be dimensioned in horizontal and vertical plans to allow Architect/Engineer to update Building Information Model (BIM) file for Owner.

1.14 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing instructions and lubrication charts and schedules.
- B. Provide electronic copies, preferably in Adobe Acrobat Portable Document Format (pdf), of all maintenance manuals to Temperature Control Contractor for use in BMS front-end system. Provide data in file types compatible with BMS.

2. PRODUCTS (NOT APPLICABLE).

3. EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 02 Sections for selective demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components specified under Division 22 and as indicated on the drawings.
 - 1. Controls
 - 2. Demolition related to others areas that must remain on line.
 - 3. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 4. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality. Refer to specific system specification for product information.

3.2 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

- B. Store and handle material and equipment in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- C. Use proper lifting equipment where size/weight requires handling by such means.
- D. Comply with manufacturer's rigging and moving instructions for unloading material and equipment, and moving them to final location.
- E. Equipment requiring disassembly for access purposes shall be disassembled and reassembled as required for movement into the final location following manufacturer's written instructions.
- F. Deliver material and equipment as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.
- G. Plumbing Contractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

3.3 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.

3.4 COORDINATION

- A. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
- B. Coordinate the plumbing work with work of the different trades so that:
 - 1. Interferences between mechanical, electrical, architectural, and structural work, including existing services, will be avoided.
 - 2. Within the limits indicated on the drawings, the maximum practicable space for operation, maintenance repair, removal and testing of mechanical and other equipment will be provided.
 - 3. Pipes, ducts, and similar items, shall be kept as close as possible to ceiling, walls, and columns, to take up a minimum amount of space. Pipes, ducts, and similar items shall be located so that they will not interfere with the intended use of other equipment.
- C. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.
- D. Furnish and install, without additional expense to the Owner, all offsets, fittings and similar items necessary in order to accomplish the requirements of coordination.

3.5 PLUMBING INSTALLATIONS

- A. All dimensions and clearances affecting the installation of work shall be verified in the field in relation to established datum, to building openings and to the work of other trades.
- B. The location of all equipment and systems shall be coordinated to preclude interferences with other construction.
- C. Should interferences occur which will necessitate deviations from layout or dimensions shown on the Drawings, the Architect/Engineer and the Owner's representative shall be notified and any changes approved before proceeding with the work.
- D. Arrange for chases, slots, and openings in other building components during progress of construction to allow for mechanical installations.
- E. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum possible headroom. Any plumbing or mechanical items planned to be installed below 8'-0" AFF shall be coordinated with engineer prior to install.
- F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- G. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect/Engineer.
- H. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- I. Install plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- J. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- K. Welding, sweating, or brazing operations
 - 1. All cutting, welding, brazing, or sweating operations carried on in the vicinity of, or accessible to, combustible material shall be adequately protected to make certain that a spark or hot slag does not reach the combustible material and start a fire.
 - 2. When it is necessary to do cutting, welding, brazing, or sweating close to wood construction, in pipe shafts, or other locations where combustible materials can not be removed or adequately protected, employ fireproof blankets and proper fire extinguishers. Position another individual nearby to guard against sparks and fire.
 - 3. Whenever combustible material has been exposed to molten metal or hot slag from welding or cutting operations, or spatter from electric arc operations, a guard shall be kept at the place of work for at least one hour after completion to verify that smoldering fires have not been started.

4. Whenever welding or cutting operations are carried on in a vertical shaft or where floor openings exist, a fire guard shall be employed to examine all floors below the point of the welding or cutting operation. The fire guard shall be kept on duty for at least one hour after completion to verify that smoldering fires have not been started.
5. Before any work involving cutting, welding, brazing, or sweating operations is started, consult with the Architect/Engineer as to particular safety precautions to be employed on the work.

3.6 ACCESSIBILITY

- A. All work shall be installed so as to be accessible for operation, maintenance and repair with particular attention given to locating valves, controls and equipment requiring periodic lubrication, cleaning, adjusting or servicing of any kind.

3.7 LUBRICATION AND TOOLS

- A. Provide a fresh charge of lubricant in accordance with manufacturer's recommendations to all equipment requiring lubrication prior to start-up and maintain lubrication as required until acceptance by Owner.
- B. Provide for each piece of equipment any special tools and a list of such tools required for the operation or adjustment of the equipment and turn over to the Owner's representative prior to final acceptance of the equipment.

3.8 PIPING SYSTEMS PRESSURE TESTING

- A. The following personnel in the order listed shall be considered acceptable witnesses of all piping pressure testing:
 1. Local Authority Having Jurisdiction
 2. Owner's Representative
 3. Mechanical Engineer / Architect
 4. General Contractor's Foreman
- B. Removal of pressure charge and associated drain down shall also be witnessed.
- C. Mechanical contractor shall provide a minimum of 24-hour notice to at least one of the above listed parties before commencing any piping systems pressure test.
- D. Pressure gauge requirements: Provide recently calibrated gauge with 4" face and a range such that test pressure is between 50% and 100% of gauge range. For example, a gauge with a 15 psig range is acceptable for a 10 psig pressure test, whereas a gauge with a 30 psig range is unacceptable in this application. Gauge resolution shall be suitable for type of testing, system size and test media. Gauge shall have been recently calibrated.
- E. All piping pressurizing equipment (i.e., air compressor) shall be disconnected before test is commenced and shall remain disconnected for the entire duration of the test.
- F. Entire system shall be properly vented before test is commenced.
- G. For specific piping pressure testing requirements and procedures, see applicable piping systems specification sections.

- H. Submit completed "Pipe Pressure Test Log" provided at the end of this Section for each pressure test before final project closeout. Test log shall also be included in operation and maintenance manuals.

NOTE: USE MULTIPLE FORMS IF NECESSARY

3.9 GENERAL CONTRACTOR - MECHANICAL EXTENT OF WORK

A. Access Panels

1. Furnish and install panels for access to valves and dampers and similar items where no other means of access, such as readily removable, sectional ceiling is shown or specified.
2. The plans indicate the location of all anticipated access panels. The Division 22 Contractor shall make every effort to locate all material and equipment requiring service and maintenance above accessible ceilings or utilize the indicated access panels. Material and equipment requiring service and maintenance that is shown above inaccessible ceilings shall be relocated to accessible or exposed areas whenever possible. When these items are located in exposed areas, the Division 22 Contractor is to verify with the Architect/Engineer that the installation will not affect the aesthetics of the building. However, when it is not possible to locate these items in accessible or exposed areas due to the configuration of the actual installation of the mechanical and other trade systems or aesthetic reasons, additional access panels shall be provided. The contractor shall be equitably compensated for the additional access panels.
3. Refer to Section 08 31 13 – Access Doors and Panels for specific information on type and size of panels

B. Cutting and Patching

1. General: Perform cutting and patching in accordance with Division 1. In addition to the requirements specified in Division 1, the following requirements apply:
2. The Division 22 Contractor shall coordinate all cutting and patching of holes, in existing building and new construction which are required for the passage of mechanical work.
3. Division 22 Contractor is to notify the General Contractor prior to submitting his bid, the number, size and location of all cutting and patching requirements. The Division 22 Contractor shall be liable for all associated costs of cutting and patching for mechanical work upon failure to notify the General Contractor prior to bid submission.
4. Under no circumstances shall any structural members, load-bearing walls or footings be cut without first obtaining written permission from the Engineer.
5. Cut, channel, chase and core drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
6. Patching of concrete openings shall be filled with grout and finished smooth with the adjacent surface.
7. All below-grade openings for pipe shall be sealed with interlocking synthetic rubber line assembly.
8. **All penetrations through the walls, floor, or structure of laboratory spaces, laboratory support spaces, lecture halls, classrooms, conference rooms, corridors or other areas in which relative pressurization relationships are important shall be sealed airtight. Refer to the drawings for additional information regarding rooms in which maintaining pressurization is important.**
9. Repair cut surfaces to match adjacent surfaces.
10. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

- a. Uncover work to provide for installation of ill-timed work.
- b. Remove and replace defective work.
- c. Remove and replace work not conforming to requirements of the Contract Documents.
- d. Remove samples of installed Work as specified for testing.
- e. Install equipment and materials in existing structures.
- f. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Excavation and Backfilling

- 1. Division 22 Contractor shall perform all excavation and backfilling necessary to install the required mechanical work. Coordinate the work with other excavating and backfilling work in the same area.
- 2. Except as indicated otherwise, comply with the applicable sections in Division 2 of these specifications, excavation filling and backfilling (for structures) to 5' outside the building line, and exterior utilities sections for beyond 5' from the building line.
- 3. Trenching: Trench width shall be no more than required for shoring, bracing and performance of the work. All necessary shoring and bracing shall be installed to ensure worker safety, proper installation of mechanical work, and protection of adjacent structures. Provide all dewatering as required. Depth shall not exceed that required to achieve the specified depth of cover and overdig will be permitted for bedding material only. All trenches shall be open cut from the surface.
- 4. Bedding: All work shall be properly bedded whether on virgin soil or on granular bedding as specified. All granular bedding shall be laid on undisturbed soil. PVC and copper piping shall have a 4" crushed stone bed conforming to specification for granular material in Division 2. If rock is encountered, excavate to a point 4" below installed bottom elevation of piping and provide bedding as called for above.
- 5. Haunching: Haunching shall be brought up on both sides of the pipe for a distance of 1/3 the pipe diameter and shall be of the same material used for bedding.
- 6. Backfill: Backfilling shall not begin until installation has been tested for leaks.
- 7. Final Backfill shall be as follows:
 - a. Outside Building Under Paved Areas: Granular material specified in Division 2.
 - b. Outside Building and Not Under Paved Areas: Clean soil free of vegetable matter and foreign material or crushed limestone. In planted areas backfill to a point 6" below finished grade. Owner will provide topsoil to finished grade.
- 8. Placement: Place all granular material in lifts of 12" maximum compacted to 100% of maximum dry density as determined as ASTM D698. Place soil in 6" lifts compacted to 95% of maximum density as determined by ASTM D698. Do not place any backfill until excavations have been cleaned of all water, debris and loose or soft soil.
- 9. Protection: At least 72 hours prior to excavating, for each phase, Contractor shall contact the Owner's Representative to arrange for utility locates in the construction area.
- 10. Contractor shall provide temporary supports for all underground utilities crossing an excavation.
- 11. Provide all required barricades, fencing, signs, lights, etc. as necessary for the protection of the workers and of the general public.
- 12. Excess Material: All excess earth and other material resulting from the excavation shall be removed from site daily by the Contractor.
- 13. Landscape work, pavement, flooring and similar exposed finish work that is disturbed or damaged by excavation shall be repaired and restored to their original condition by the Mechanical Contractor.

D. Concrete Bases

1. Minimum 4" high concrete housekeeping pads shall be provided under floor mounted mechanical equipment. Concrete inertia pads shall be provided for all base-mounted pumps and air compressors installed above grade.
2. Division 22 Contractor is to notify the General Contractor prior to submitting his bid, the number, size and location of all mechanical equipment bases. The Division 22 Contractor shall be liable for all associated costs to install the mechanical equipment bases upon failure to notify the General Contractor prior to bid submission.
3. Construct concrete equipment bases a minimum 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000 psi, 28-day compressive strength concrete, reinforcement and forms as specified in Division 3 Section "Cast-In-Place Concrete." Coordinate final equipment base size with General Contractor.

E. Roof curbs, roof support for mechanical equipment and roof penetrations.

1. Division 22 Contractor is to coordinate with the General Contractor all roof curb and roof supports supplied, number, size and location of all roof penetrations. All major roof penetrations are shown on the architectural roof plan. General Contractor shall be notified of all additional roof penetrations provided by the Division 22 Contractor not shown on this plan. The General Contractor shall provide all roof deck mounted equipment and pipe supports, pipe penetrations and cut roof deck for pipe and duct penetrations, unless noted otherwise. The Division 22 Contractor shall furnish all roof curbs and the General Contractor shall install, unless noted otherwise. The Division 22 Contractor shall provide all roof covering/membrane mounted equipment and pipe supports and roof drains, unless noted otherwise.
2. The Division 22 Contractor shall be liable for all associated costs to install the roof curbs, roof supports and roof penetrations not shown on the roof plan or added after the roof system has been installed. Coordinate with the General Contractor prior to construction the number size and location of all roof penetrations.
3. Division 22 Contractor is to coordinate with the General Contractor all roof curb and roof supports supplied, number, size and location of all roof penetrations. All major roof penetrations are shown on the architectural roof plan. General Contractor shall be notified of all additional roof penetrations provided by the Division 22 Contractor not shown on this plan.

F. Painting

1. The General Contractor is to field paint mechanical equipment and materials in specified areas as noted on the mechanical plans, mechanical schedules and in the specifications. Division 22 Contractor is to coordinate the painting of these items with the General Contractor. The Mechanical Contractor is to provide materials in these areas that are suitable for accepting paint. The clean and preparation of the materials to reach paint is the responsibility of the General Contractor unless noted specifically to be responsibility of the Division 22 Contractor.
2. In concealed locations, field-fabricated bare iron or steel items required for installation of work under this Division shall have rough or sharp edges removed and shall be painted with one coat of zinc rich paint.

3.10 ELECTRICAL-PLUMBING EXTENT OF WORK

- A. The responsibility of work specified under Division 22 and 26 is clarified under, Section 22 05 13, "Electrical Requirements for Plumbing Equipment." Division 22 Contractor is to coordinate all electrical requirements prior to ordering powered plumbing equipment.

END OF SECTION 22 05 00

PIPE PRESSURE TEST LOG											
PROJECT:											
BUILDING:						GENERAL CONTRACTOR:					
CLARK ENERSEN PROJECT NUMBER:						MECHANICAL CONTRACTOR:					
TEST INFORMATION						TEST PRESSURE					
TEST DATE	PIPI NG SYS TEM	AREA TESTED	TEST MEDIA (WATER OR AIR)	TEST DURATION (MINUTES)	PRESSURE GAGE NUMBER	INITIAL (PSIG)	FINAL (PSIG)	TESTED BY	WITNESSED BY	PASS / FAIL (P/F)	COMMENTS

ADDITIONAL

COMMENTS:

PRESSURE GAGE INFORMATION											
GAGE NUMBER	MANUFACTURER	PRESSURE RANGE	RESOLUTION	STYLE	DIAL SIZE	GAGE NUMBER	MANUFACTURER	PRESSURE RANGE	RESOLUTION	STYLE	DIAL SIZE

NOTE: USE MULTIPLE FORMS IF NECESSARY

SECTION 22 05 13 – ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

1. GENERAL

1.1 SECTION INCLUDES

A. Electrical Requirements for:

1. Motors
2. Starters, Electrical Devices, and Wiring
3. Manual Motor Starters
4. Motor Connections
5. Capacitors
6. Safety Switches

1.2 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING:

A. Quality assurance.

1. Electrical components and materials shall be UL labeled and listed.

B. References.

1. The design, manufacture, testing and method of installation of all equipment and materials furnished under the requirements of this specification section shall conform to the following:
 - a. AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
 - b. AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.
 - c. ANSI/IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators.
 - d. ANSI/NEMA Standard MG 1 – Motors and Generators.
 - e. ANSI/NFPA 70 - National Electrical Code.
 - f. NEMA Standard ICS 2 – Industrial Control Devices, Controllers, and Assemblies.
 - g. NEMA Standard 250 – Enclosures for Electrical Equipment.
 - h. NEMA Standard KS 1 – Enclosed Switches.

C. Submittals.

1. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, or as required by the individual equipment specification sections.

D. Operation and maintenance manuals.

E. Project record documents.

F. Delivery, storage, and holding

G. Related sections.

1. Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.

1.3 SUMMARY

- A. This section specifies the basic requirements for electrical components which are an integral part of packaged plumbing equipment. These components include, but are not limited to factory installed motors, starters, and disconnect switches furnished as an integral part of packaged plumbing equipment. In addition, this section covers necessary coordination issues between plumbing and electrical disciplines. All plumbing and electrical construction documents must be completely reviewed by the Plumbing and Electrical Contractors prior to the submission of bids. Any discrepancies in the documents should be brought to the Architect/Engineer's attention at that time. Failure to properly coordinate or review documents in advance of submission of bids will not be valid cause for changes to the overall Contract amount.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for plumbing equipment are scheduled on the Drawings.

2. PRODUCTS

2.1 MOTORS

- A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
 1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
 2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. Minimum service factors shall be as follows:

Motor Service Factor Schedule		
Horsepower:	3600 RPM:	1800 RPM:
1/6 – 1/3	1.35	1.35
1/2	1.25	1.25
3/4	1.25	1.25
1 – 1.25	1.25	1.15
1.5 - 150	1.15	1.15

3. Two-speed poly-phase motors shall have two separate windings served by a single point electrical connection to the two speed starter. Two speed starters shall be located at the motor location unless otherwise noted.
4. Temperature Rating: Rated for 40 deg. C environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).
5. Starting capability: Frequency of starts as indicated by automatic control system, and not less than five (5) evenly timed starts per hour for manually controlled motors.
6. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.

- a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit each specific application.
 - b. Bearings: Ball or roller bearings with inner and outer shaft seals; re-greasable; designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor; for fractional horsepower, light duty motors, sleeve type bearings are permitted.
 - c. Enclosure Type: Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation; guarded drip-proof motors where exposed to contact by employees or building occupants; weather protected Type I for outdoor use, Type II where not housed.
 - d. Overload protection: Built-in thermal overload protection (in accordance with NEC requirements) and, where indicated, an internal sensing device suitable for signaling and stopping the motor at the starter.
- 7. Noise rating: "Quiet"
 - 8. Efficiency: **"Premium efficiency"** motors, as defined in NEMA MG 1, most recent edition.
 - 9. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
 - 10. All three-phase motors shall be inverter duty type.
 - 11. Motors Used With Variable Frequency Drives: Ratings, characteristics, and features coordinated with and approved by drive manufacturer. Motor shall be designed and labeled for use with variable frequency drives. Motor shall be designed with critical vibration frequencies outside the operating range of the drive output and shall be suitable for use throughout speed range without overheating.
- a. Provide AEGIS SGR, or approved equivalent, shaft grounding ring/system to divert adverse shaft currents away from the motor bearings. Use AEGIS Colloidal Silver Shaft Coating (PN CS015), or approved equivalent, prior to ring installation. Install coating and ring per manufacturer recommendations.

2.2 STARTERS, ELECTRICAL DEVICES, AND WIRING

- A. Motor-Starter Characteristics: Motor starters shall be compatible with the equipment they serve. In general, motor starter characteristics shall meet the requirements of Division 26 specification sections and as outlined as follows:
- B. Motor Connections
 - 1. Provide connections to motors in accordance with the requirements listed in the electrical specifications.
 - 2. See Division 26 for the use of lugs for motor connections.
- C. Capacitors
 - 1. Capacitor features shall include:
 - a. Individual unit cells.
 - b. All welded steel housing.
 - c. Each capacitor shall be internally fused.
 - d. Non-flammable synthetic liquid impregnate.
 - e. Craft tissue insulation.

- f. Aluminum foil electrodes
- 2. KVAR size shall be determined by the Contractor/Supplier and shall correct motor power factor to 95 percent or better and shall be installed on all motors 10 horsepower and larger that have an uncorrected power factor of less than 85 percent at rated load. Power factor correction is not required for motors used in conjunction with variable frequency drives.

D. CAPACITORS

- 1. Capacitor features shall include:
 - a. Individual unit cells.
 - b. All welded steel housing.
 - c. Each capacitor shall be internally fused.
 - d. Non-flammable synthetic liquid impregnate.
 - e. Craft tissue insulation.
 - f. Aluminum foil electrodes
- 2. KVAR size shall be determined by the Contractor/Supplier and shall correct motor power factor to 95 percent or better and shall be installed on all motors 10 horsepower and larger that have an uncorrected power factor of less than 85 percent at rated load. Power factor correction is not required for motors used in conjunction with variable frequency drives.

3. EXECUTION

- 3.1 All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- 3.2 For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.
- 3.3 For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations. Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.
- 3.4 CONTRACTOR COORDINATION
 - A. It is the responsibility of the Contractor and all Subcontractors to coordinate scope to ensure that all required electrical connections and control connections are provided in accordance with all specification sections. The Architect/Engineer is not responsible for determining which Contractor or Subcontractor will provide particular items.

END OF SECTION 22 05 13

SECTION 22 05 19 – PLUMBING METERS AND GAUGES

1. GENERAL

1.1 SECTION INCLUDES

- A. Pressure gages and pressure gage taps.
- B. Liquid-in-Glass Thermometers
- C. Glass Thermometers
- D. Thermometer wells.
- E. Piping pressure and temperature test plugs.
- F. Sight flow indicators.

1.2 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
- B. References
- C. Submittals
 - 1. Product Data: For each type of product.
 - a. Include diagrams for power, signal, and control wiring.
- D. Operation and maintenance manuals.
- E. Project record documents
 - 1. Accurately record actual locations of instrumentation.
- F. Delivery, storage, and handling

1.3 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with International Plumbing Code.
- B. Provide lead-free materials (0.25% lead by weighted average) for applicable potable water meters, materials, piping, valves, fittings, backflow preventers, and other items in accordance with NSF/ANSI 61, including Appendix G.

- C. Provide lead-free materials (0.25% lead by weighted average) for applicable potable water faucets, faucet connectors, hoses, supply stops, and other items in accordance with NSF/ANSI 61, including Appendix 9-G.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

2. PRODUCTS

2.1 PRESSURE GAUGES

- A. Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube type, bottom connection, liquid-filled.
- B. Case: Drawn steel or brass, glass lens, 4-1/2-inches diameter.
- C. Connector: Brass, 1/4-inch NPS.
- D. Scale: White coated aluminum, with permanently etched markings.
- E. Accuracy: Plus or minus 1 percent of range span.
- F. Range: Conform to the following:
 - 1. Vacuum: 30 inches Hg to 15 psi.
 - 2. All fluids: 2 times operating pressure.

2.2 PRESSURE GAUGE ACCESSORIES

- A. Syphon: 1/4-inch NPS straight coil constructed of brass tubing with threads on each end.
- B. Snubber: ASME B40.100, 1/4-inch NPS brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure. Provide extension for use on insulated systems.

2.3 THERMOMETERS, GENERAL

- A. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.
- B. Scale range: Temperature ranges for services listed as follows:
 - 1. Domestic Hot Water: 30 to 240 deg with 2-degree scale divisions (0 to 115 deg C with 1-degree scale divisions).
 - 2. Domestic Cold Water: 0 to 100 deg F with 2-degree scale divisions (minus 18 to 38 deg C with 1-degree scale divisions).

2.4 LIQUID-IN-GLASS THERMOMETERS

- A. Case: Die cast, aluminum finished, in baked epoxy enamel, glass front, spring secured, 9 inches long.
- B. Adjustable Joint: Finished to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
- C. Tube: Red reading, mercury filled, magnifying lens.
- D. Scale: Satin-faced, nonreflective aluminum, with permanently etched markings.
- E. Stem: Copper-plated steel, aluminum or brass, for separable socket, length to suit installation.
- F. ASME B40.200

2.5 GLASS THERMOMETERS

- A. Standard: ASME B400.200.
- B. Case: Die cast, aluminum finished, in baked epoxy enamel, glass front, spring secured, 9 inches long.
- C. Adjustable Joint: Finished to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
- D. Tube: Red reading, magnifying lens, with non-mercury fluid.
- E. Scale: Satin-faced, nonreflective aluminum, with permanently etched markings.
- F. Stem: Copper-plated steel, aluminum or brass, for separable socket, length to suit installation.

2.6 THERMOMETER WELLS

- A. Thermometer Wells: ASME B40.200, Brass or stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

2.8 SIGHT FLOW INDICATORS

- A. Bronze or stainless-steel body, with sight glass and paddle wheel indicator, threaded or flanged ends.
- B. Minimum pressure rating: 150 psig.
- C. Minimum temperature rating: 200 deg F.
- D. End connections for NPS 2 inch and smaller: Threaded.
- E. End Connections for NPS 2-1/2 inch and larger: Flanged.

3. EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturer's instructions.

3.2 PRESSURE GAUGES

- A. Install pressure gauges in piping tee with pressure gauge valve, located on pipe at most readable position.
- B. Install as shown on plans, and elsewhere as indicated.
- C. Pressure Gauge Ball Valves: Install in piping tee with snubber. Install syphon in lieu of snubber for steam pressure gages.
- D. Pressure Gauge Accessories:
 - 1. Install ball valve between system and pressure gauge.
 - 2. Install in piping tee with snubber.
- E. If applicable, cut rubber nipple on top of pressure gauge per manufacturer recommendations.

3.3 THERMOMETERS

- A. Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.
- B. Install as shown on drawings.
- C. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap. Provide extension on insulated systems. Install in socket extending to center of pipe.

3.4 TEST PLUGS

- A. Test Plugs: Install where indicated, located on pipe at most readable position. Secure cap.

3.5 ADJUSTING AND CLEANING

- A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.
- B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.

END OF SECTION 22 05 19

SECTION 22 05 29 – PLUMBING HANGERS AND SUPPORTS

1. GENERAL

1.1 SECTION INCLUDES

- A. Metal pipe hangers and supports
- B. Trapeze pipe hangers.
- C. Metal framing systems.
- D. Thermal hanger-shield inserts.
- E. Fastener systems.
- F. Pipe Stands
- G. Pipe-positioning systems.
- H. Equipment supports.

1.2 REFERENCES

- A. ANSI/ASME B31.1 – Power Piping.
- B. ANSI/AMSE B31.9 – Building Services Piping.
- C. MSS SP-58 – Pipe Hangers and Supports – Materials, Design, and Manufacture.
- D. MSS SP-89 – Pipe Hangers and Supports – Fabrication and Installation Practices.

1.3 RELATED DOCUMENTS

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

1.4 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING GUIDELINES

- A. Submittals
 - 1. Product Data and Details: For each type of product.
 - 2. Shop Drawings:
 - a. Trapeze pipe hangers.
 - b. Metal framing Systems.
 - c. Fiberglass strut systems.
 - d. Pipe stands.

- e. Equipment supports
- 3. Delegated Design:
 - a. Design supports for multiple pipes,, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - c. Design seismic-restraint hangers and supports for piping and equipment
- 4. Welding certificates
 - a. Qualify procedures and personnel according to AWS D1.1/D1.1M
 - b. Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX

2. PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
6. Hanging Cables with Adjustable Fastener: Gripple Hanging Cable Kit with the following:
 - a. Wire Rope: High tensile steel wire rope, to EN12385 or ASTM A1023/1023M, class A zinc coating; 7 by 7 and/or 7 by 19 cross-sectional construction; having a tensile strength of 256,000 psi; lengths, diameters, and wire construction to accommodate design loads.
 - b. Adjustable Fastener: one-piece die cast Type ZA2 zinc one-channel body; encasing a series of Type 302 stainless steel springs with serrated self-locking wedges made of sintered steel hardened to minimum 56 Rockwell C, adjustable by means of an integrated mechanism, with safe working load of 120 lb, 240 lb, 550 lb, or 800 lb depending on application., with safety factor of 5:1.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel
3. Hanging Cables with Adjustable Fastener: Gripple Hanging Cable Kit with the following:
 - a. Wire Rope: High tensile steel wire rope, to EN12385 or ASTM A1023/1023M, class A zinc coating; 7 by 7 and/or 7 by 19 cross-sectional construction; having a tensile strength of 256,000 psi; lengths, diameters, and wire construction to accommodate design loads.

- b. Adjustable Fastener 1: one-piece die cast Type ZA2 zinc one-channel body; encasing a series of Type 302 stainless steel springs with serrated self-locking wedges made of sintered steel hardened to minimum 56 Rockwell C, adjustable by means of an integrated mechanism, with safe working load of 120 lb, 240 lb, 550 lb, or 800 lb, depending on application, with safety factor of 5:1.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:

- 1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
- 2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
- 3. Channels: Continuous slotted carbon-steel channel with inturned lips. Example: Gripple Universal Bracket or other approved equivalent.
- 4. Channels with integrated latching mechanisms: Continuous slotted carbon-steel channel with inturned lips that comes with integrated latching mechanisms on both ends and slotted straps as a hanging member. Example: Gripple Fast Trak system or other approved equivalent.
- 5. Channel Width: Selected for applicable load criteria.
- 6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
- 7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel

- B. Non-MFMA Manufacturer Metal Framing Systems:

- 1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
- 2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
- 3. Channels: Continuous slotted carbon-steel channel with inturned lips.
- 4. Channel Width: Select for applicable load criteria.
- 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
- 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel

2.4 THERMAL HANGER-SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Indoor Applications: Zinc-coated steel.
 - 2. Outdoor Applications: Stainless steel.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand:
 - 1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 - 3. Hardware: Galvanized steel or polycarbonate.
 - 4. Accessories: Protection pads.
- C. Low-Profile, Single-Base, Single-Pipe Stand:
 - 1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
 - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 - 3. Vertical Members: Two galvanized steel, continuous-thread, 1/2-inch rods.
 - 4. Horizontal Member: Adjustable horizontal, galvanized steel pipe support channels.
 - 5. Pipe Supports: Roller or Strut clamps or Clevis hanger or Swivel hanger
 - 6. Hardware: Galvanized steel.
 - 7. Accessories: Protection pads.
 - 8. Height: 12 inches above roof
- D. High-Profile, Single-Base, Single-Pipe Stand:
 - 1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Single vulcanized rubber or molded polypropylene.
 - 3. Vertical Members: Two galvanized steel, continuous-thread, 1/2-inch rods.
 - 4. Horizontal Member: One adjustable-height, galvanized steel, pipe-support slotted channel or plate.

5. Pipe Supports: Roller or Clevis hanger or Swivel hanger.
6. Hardware: Galvanized steel.
7. Accessories: Protection pads, 1/2-inch continuous-thread, galvanized-steel rod
8. Height: 36 inches above roof

E. High-Profile, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: Two or more; vulcanized rubber or molded polypropylene
3. Vertical Members: Two or more, galvanized steel channels.
4. Horizontal Members: One or more, adjustable-height, galvanized steel pipe support.
5. Pipe Supports: Roller or Strut clamps or Clevis hanger or Swivel hanger.
6. Hardware: Galvanized steel.
7. Accessories: Protection pads, 1/2-inch continuous-thread rod.
8. Height: 36 inches above roof.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE-POSITIONING SYSTEMS

A. Description:

1. IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications. Or
2. Pipe positioning clamps with listing reports from ICC-ES or IAPMO-UES. Example: Gripple GC, GCS series or other approved equivalent.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.9 MATERIALS

- A. Aluminum: ASTM B221
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.

3. EXECUTION

3.1 APPLICATION

- A. 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 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
- G. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2** and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- O. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. MSS SP-58, Type 39: Install protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe **4"** and larger if pipe is installed on rollers.
 - 3. MSS SP-58, Type 40: Install protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe **4"** and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 INSTALLATION OF EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touchup:
 1. Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

2. Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 09 91 23 "Interior Painting."

- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
- F. Use stainless steel pipe hangers, fiberglass pipe hangers, and/or fiberglass strut systems, as well as stainless steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal hanger-shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.8 SPECIFIC HANGER AND SUPPORT REQUIREMENTS

A. PIPING SUPPORT SPACING SCHEDULE

PIPING MATERIAL ^a	MAX. HORIZONTAL SPACING (ft.):	MAX. VERTICAL SPACING (ft.):
ABS pipe	4	10 ^c
Aluminum pipe and tubing	10	15
Brass pipe	10	10
Cast-iron pipe ^b	5	15
Copper or copper-alloy pipe	12	10
Copper or copper-alloy tubing ^d	8	10
CPVC pipe or tubing, 1 inch and smaller	3	10 ^c

CPVC pipe or tubing, 1-1/4 inch and larger	4	10 ^c
Lead pipe	Continuous	4
PE-AL-PE pipe or tubing	32 inches	4
PE-RT 1 inch and smaller	32 inches	10 ^c
PE-RT 1-1/4 inch and larger	4	10 ^c
PEX tubing 1 inch and smaller	32 inches	10 ^c
PEX 1-1/4 inch and larger	4	10 ^c
Polypropylene (PP) pipe or tubing, 1 inch and smaller	32 inches	10 ^c
Polypropylene (PP) pipe or tubing, 1-1/4 inch and larger	4	10 ^c
PVC pipe	4	10 ^c
Stainless steel drainage systems	10	10 ^c
Steel pipe ^d	12	15

PIPING SUPPORT SPACING SCHEDULE NOTES:

- a: Refer to International Plumbing Code for additional requirements.
- b: The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.
- c: For sizes 2 inches and smaller, a guide shall be installed midway between required vertical supports. Such guides shall prevent pipe movement in a direction perpendicular to the axis of the pipe.
- d: Refer to International Fuel Gas Code for support intervals for fuel gas piping.

END OF SECTION 22 05 29

SECTION 22 05 53 – PLUMBING IDENTIFICATION

1. GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.

1.2 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING GUIDELINES

- A. References
- B. Related Sections
 - 1. Product Data: For each type of product indicated.
 - 2. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
 - 3. Valve-numbering scheme.
 - 4. Valve Schedules: For each piping system. Include in operation and maintenance manuals.
- C. Quality Assurance

1.3 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 closeout specifications.
- B. Record actual locations of tagged valves.

2. PRODUCTS

2.1 NAMEPLATES

- A. Equipment Mark Nameplates: Laminated three-layer plastic with engraved black letters (matching equipment mark indicated on drawings) on light contrasting background color, with minimum 3/4 inch high letters.
- B. Equipment Nameplates: Factory-applied permanent nameplate indicating the manufacturer's name, model, serial number, temperature and pressure design, and any other data necessary to conform with specified requirements. On equipment installed outdoors, nameplate shall be stamped steel or engrave plastic.

2.2 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter or square.
- B. Chart: Typewritten list that is plastic laminated and mounted in mechanical room. Valve list is to coordinate with mechanical piping schematics if provided on plans.
- C. Pipe Schematics: Valve numbers are to be labeled on Engineer schematic drawings, plastic laminated and schematic shall be mounted in mechanical room.

2.3 PIPE MARKERS

- A. Reference ASME A13.1 for the following:
 - 1. Color
 - 2. Letter height and label length based on pipe diameter
 - 3. Minimum content requirements
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings; minimum information indicating flow direction arrow and identification of fluid being conveyed and hazard legend where applicable.
- C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service. Provide tape with printing which most accurately indicates the type of service of buried pipe.

3. EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic tape pipe markers in accordance with manufacturer's instructions. Directional arrow tape shall be overlapped to ensure proper adhesion and no peeling of tape in future.
- D. Identify centralized plumbing equipment with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- E. Identify valves and meters with tags.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify valves in main and branch piping with tags.

- H. Tag automatic controls, instruments, and relays. Key to control schematic.
- I. Identify piping, concealed or exposed, with plastic tape pipe markers. Identify service, flow direction, and pressure when applicable, i.e. low pressure steam, high pressure steam. Install in clear view from floor and align with axis of piping. Locate identification not to exceed 15 feet on straight runs including risers and drops, more often in congested areas, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Provide a minimum one label per pipe per room. Where pipes are racked, install pipe markers on each pipe in the same location to aid in differentiating each pipe in the rack.
- J. For division 22 piping systems, install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe. Reference division 33 specifications for tracer wire requirements.

END OF SECTION 22 05 53

SECTION 22 05 93 - TESTING, ADJUSTING, AND BALANCING FOR PLUMBING

1. GENERAL

1.1 SECTION INCLUDES

- A. TAB of domestic water system.
- B. TAB of plumbing equipment:
 - 1. Domestic hot-water in-line circulation pumps.
 - 2. Water Heaters.
- C. Pipe-leakage test verification.
- D. Testing, adjusting, and balancing existing plumbing systems and equipment.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

1.3 RELATED SECTIONS

- A. Specification Section 23 05 93 – Testing, Adjusting, and Balancing

1.4 PREINSTALLATION MEETINGS

- A. TAB Conference: Conduct a TAB conference after approval of the TAB strategies and procedures plan, to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
- B. Minimum Agenda Items:
 - 1. Coordinate requirements in subparagraphs below with Section 013100 "Project Management and Coordination."
 - 2. The Contract Documents examination report.
 - 3. The TAB plan.
 - 4. Needs for coordination and cooperation of trades and subcontractors.
 - 5. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 60 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.
- C. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.
- D. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- E. Certified TAB reports.
- F. Sample report forms.
- G. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.6 QUALITY ASSURANCE

- A. TAB Specialists Qualifications, Certified by NEBB or TABB:
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE 188 Compliance: Comply with balancing and report requirements, Section 8.3 "Balancing."
- D. Code and Authorities Having Jurisdiction Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.7 FIELD CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.8 PROJECT RECORD DOCUMENTS

1. Record actual locations of all sensors, flow measuring stations, balancing valves and rough setting.

1.9 SCHEDULING/COORDINATION

1. Notice: Provide seven days advance notice for each test. Include scheduled test dates and times.
2. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, and balancing valves and fittings. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine approved submittals for plumbing systems and equipment.
- D. Examine design data, including plumbing system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about plumbing system and equipment controls.
- E. Examine equipment performance data, including pump curves.
 1. Relate performance data to Project conditions and requirements, including pump system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate pump system-effect factors to reduce performance ratings of plumbing equipment when installed under conditions different from the conditions used to rate equipment performance. Compare results with the design data and installed conditions.
- F. Examine system and equipment installations, and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine plumbing equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- I. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainers are installed and clean.

- J. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.
- K. Examine system pumps to ensure absence of entrained air in the suction piping.
- L. Examine operating safety interlocks and controls on plumbing equipment.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of plumbing systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Domestic Water System:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed in accordance with applicable code and authority having jurisdiction.
 - b. Water heaters are installed and functioning.
 - c. Piping is complete and all points of outlet are installed.
 - d. Water treatment is complete.
 - e. Systems are flushed, filled, and air purged.
 - f. Strainers are clean.
 - g. Control valves are functioning in accordance with the sequence of operation.
 - h. Shutoff and balance valves are 100 percent open.
 - i. Hot-water circulating pumps are operational and proper rotation is verified.
 - j. Pump gauge connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
 - k. Variable-frequency controllers' startup is complete and safeties are verified.
 - l. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. Where holes for probes are required in piping or equipment, install pressure and temperature test plugs to seal systems.

2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 220719 "Plumbing Piping Insulation."
- C. Mark equipment and balancing devices, including valve position indicators and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR PLUMBING EQUIPMENT

- A. Test, adjust, and balance plumbing equipment indicated on Drawings, including, but not limited to, the following:
 1. Motors.
 2. Domestic water booster pumps.
 3. Domestic water in-line pumps.
 4. Domestic water heaters.
 5. Sanitary sewage pumps.
 6. Drainage pumps.
 7. Air compressors.
 8. Vacuum pumps.

3.5 PROCEDURES FOR DOMESTIC WATER SYSTEMS

- A. Prepare test reports for pumps and other equipment. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required equipment flow rates with system design flow rates.
- B. Prepare schematic diagrams of systems' Record drawings piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare domestic water systems for testing and balancing as follows:
 1. Check expansion tank for proper setting.
 2. Check water heater for proper discharge temperature setting.
 3. Check remotest point of outlet for adequate pressure.
 4. Check flow-control valves for proper position.
 5. Locate start-stop and disconnect switches, electrical interlocks, and motor controllers.
 6. Verify that motor controllers are equipped with properly sized thermal protection.
 7. Check that air has been purged from the system.
- D. Measure and record upstream and downstream pressure of each piece of equipment.
- E. Measure and record upstream and downstream pressure of pressure-reducing valves.
- F. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
- G. Check settings and operation of each safety valve. Record settings.

3.6 PROCEDURES FOR DOMESTIC HOT-WATER CIRCULATING INLINE PUMP

- A. Balance system with manual or automatic balancing valves by setting at design flow.
 - 1. Measure flow in main and branch pipes.
 - 2. Adjust main and branch balance valves for design flow.
 - 3. Re-measure each main and branch after all have been adjusted.
- B. Adjust pump to deliver total design flow.
 - 1. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gauge heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
 - 2. Monitor motor performance during procedures, and do not operate motor in an overloaded condition.
 - 3. Mark final settings and verify that all memory stops have been set.
 - 4. Verify final system conditions as follows:
 - a. Re-measure and confirm that total flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, speed, and static profile.
 - c. Mark final settings.

3.7 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Phase and hertz.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter size and thermal-protection-element rating.
 - 8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR WATER HEATERS

- A. Electric Water Heaters:

1. Measure and record entering- and leaving-water temperatures.
2. Measure and record water flow.
3. Measure and record pressure drop.
4. Measure and Record relief valve(s) pressure setting.
5. Capacity: Calculate in Btu/h (kW) of heating output.
6. Efficiency: Calculate operating efficiency for comparison to submitted equipment.

B. Gas- and Oil-Fired Water Heaters:

1. Measure and record entering- and leaving-water temperatures.
2. Measure and record water flow.
3. Measure and record pressure drop.
4. Measure and Record relief valve(s) pressure setting.
5. Capacity: Calculate in Btu/h (kW) of heating output.
6. Fuel Consumption: If fuel supply is equipped with flow meter, measure and record consumption.
7. Efficiency: Calculate operating efficiency for comparison to submitted equipment.
8. Fan, motor, and motor controller operating data.

3.9 TOLERANCES

A. Set plumbing system's flow rates within the following tolerances:

1. Domestic Water Flow Rate: Plus or minus 5 percent. If design value is less than 10 gpm, within 10 percent.
2. Compressed-Air Flow Rate: Plus or minus 5 percent. If design value is less than 10 gpm, within 10 percent.
3. Vacuum Flow Rate: Plus or minus 5 percent.

3.10 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to plumbing systems and general construction to allow access for performance-measuring and -balancing devices.
- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
 3. Certify validity and accuracy of field data.

- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents, including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Notes to explain why certain final data in the body of reports vary from indicated values.
 14. Test conditions for pump performance forms, including the following:
 - a. Variable-frequency controller settings for variable-flow hydronic systems.
 - b. Settings for pressure controller(s).
 - c. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of distribution systems. Present each system with single-line diagram and include the following:
1. Flow rates.
 2. Pipe and valve sizes and locations.
 3. Balancing stations.
 4. Position of balancing devices.
- E. Gas- and Oil-Fired Water Heaters Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.

- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Fuel type in input data.
- g. Output capacity in Btu/h.
- h. Ignition type.
- i. Burner-control types.
- j. Motor horsepower and speed.
- k. Motor volts, phase, and hertz.
- l. Motor full-load amperage and service factor.
- m. Sheave make, size in inches, and bore.
- n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Entering-water temperature in deg F.
- c. Leaving-water temperature in deg F.
- d. Low-fire fuel input in Btu/h.
- e. High-fire fuel input in Btu/h.
- f. High-temperature-limit setting in deg F.
- g. Operating set point in Btu/h.
- h. Heating value of fuel in Btu/h.

F. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves, and include the following:

1. Unit Data:

- a. Unit identification.
- b. Location.
- c. Service.
- d. Make and size.
- e. Model number and serial number.
- f. Water flow rate in gpm.
- g. Water-pressure differential in feet of head or psig.
- h. Required net positive suction head in feet of head or psig.
- i. Pump speed.
- j. Impeller diameter in inches.
- k. Motor make and frame size.
- l. Motor horsepower and rpm.
- m. Voltage at each connection.
- n. Amperage for each phase.
- o. Full-load amperage and service factor.
- p. Seal type.

2. Test Data (Indicated and Actual Values):

- a. Static head in feet of head or psig.
- b. Pump shutoff pressure in feet of head or psig.
- c. Actual impeller size in inches.
- d. Full-open flow rate in gpm.
- e. Full-open pressure in feet of head or psig.
- f. Final discharge pressure in feet of head or psig.

- g. Final suction pressure in feet of head or psig.
- h. Final total pressure in feet of head or psig.
- i. Final water flow rate in gpm.
- j. Voltage at each connection.
- k. Amperage for each phase.

G. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 22 05 93

SECTION 22 07 19 – PLUMBING PIPING INSULATION

1. GENERAL

1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.2 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING GUIDELINES

- A. Quality assurance.
 - 1. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255, and UL 723.
- B. References.
- C. Submittals.
 - 1. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
 - 2. Insulation Schedule: Include pipe insulation schedule that includes pipe system, pipe sizes, insulation type, insulation thickness, and jacket type (where applicable).
 - 3. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 4. Detail attachment and covering of heat tracing inside insulation.
 - 5. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 6. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 7. Detail application of field-applied jackets.
- D. Operation and maintenance manuals.
- E. Project record documents.
- F. Environmental requirements
 - 1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
 - 2. Maintain temperature during and after installation for minimum period of 24 hours.

2. PRODUCTS

2.1 GLASS FIBER

- A. Insulation: ASTM C547; rigid molded, noncombustible.

1. 'K' ('ksi') value: ASTM C335.

Temperature (degrees F)	Maximum 'k' value (btu*in)/(hr*ft ² *deg F))
75	0.23
100	0.24
150	0.25
200	0.28
300	0.34

2. Minimum Service Temperature: -20 degrees F.
3. Maximum Service Temperature: 300 degrees F.
4. Maximum Moisture Absorption: 0.2 percent by volume.

B. Vapor Barrier Jacket

1. ASTM C921, White kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
3. Secure with self sealing longitudinal laps and butt strips.
4. Secure with outward clinch expanding staples and vapor barrier mastic.

C. Tie Wire: 18 gage stainless steel with twisted ends on maximum 12 inch centers.

D. Vapor Barrier Lap Adhesive: MIL-A-3316C, Class 2, Grade A compliant. Compatible with insulation. VOC Limit 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Insulating Cement: ASTM C195; hydraulic setting on mineral wool. VOC Limit 70 g/L (multipurpose construction adhesive).

F. Fibrous Glass Fabric: Cloth, untreated; 9 oz/sq yd weight with 1.0 lb/cu ft density blanket.

G. Indoor Vapor Barrier Finish: Vinyl emulsion type acrylic, compatible with insulation, white color. VOC Limit 50 g/L.

2.2 CELLULAR FOAM

A. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.

1. 'k' ((btu*in)/(hr*ft²*deg F)) value: ASTM C177 or C518; 0.21 to 0.27 at 75 degrees F mean temperature rating.
2. Minimum Service Temperature: -40 degrees F.

3. Maximum Service Temperature: 220 degrees F.
 4. Maximum Moisture Absorption: ASTM C209; 0.2 percent by volume.
 5. Moisture Vapor Transmission: ASTM E96; <0.10 perm inches.
 6. Maximum Flame Spread: ASTM E84; 25.
 7. Maximum Smoke Developed: ASTM E84; 50.
 8. Connection: Waterproof vapor barrier adhesive.
 9. Provide documentation indicating that product contains no urea formaldehyde.
 10. Fittings: Pre-fabricated closed cell fittings of like material and thickness as adjacent pipe insulation.
 11. In all exposed finished areas without jacketing, provide white insulation, otherwise use black.
- B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. MIL-A-24179A, Type II, Class I, compliant. Air dried, contact adhesive, compatible with insulation. VOC Limit: 50 g/L or less when calculated according to 40 CFR 59, Subpart D.

2.3 JACKETS

A. PVC Plastic

1. Jacket: ASTM C921, One piece molded type fitting covers and sheet material, white color.
 - a. Minimum Service Temperature: -40 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches.
 - d. Maximum Flame Spread: ASTM E84; 25.
 - e. Maximum Smoke Developed: ASTM E84; 50.
 - f. Thickness: 20 mil.
 - g. Connections: Brush on welding adhesive or pressure sensitive color matching vinyl tape.
2. Covering Adhesive Mastic: Compatible with insulation. VOC Limit 50 g/L according to 40 CFR 59, Subpart D (EPA Method 24).

3. EXECUTION

3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Painting of cellular foam insulation is not allowed, provide an approved jacket.**
- C. On exposed piping, locate insulation and cover seams in least visible locations. For cellular foam insulation tape ALL visible seams with tape matching insulation color.

- D. All exposed insulation shall be installed with an approved jacket.
- E. Cellular foam insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
1. Insulate fittings, joints, flanges, unions, strainers, flexible connectors, and valves with molded insulation of like material and thickness as adjacent pipe.
 2. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 3. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- F. For insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 3. Finish with glass cloth and adhesive.
 4. For hot piping conveying fluids, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. Inserts and Shields:
1. Refer to Section 22 05 29 for additional information.
 2. Application: Piping 1 inch diameter or larger.
 3. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 4. Insert Location: Between support shield and piping and under the finish jacket.
 5. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 6. Insert Material: ASTM C640 cork, hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
 7. Provide inserts and/or shields per manufacturer recommendations for cellular foam insulation applications in order to maintain continuous insulation throughout the pipe system. The removal of sections of cellular foam insulation to accommodate pipe supports is not acceptable. Manufacturer products specifically designed for supporting insulation and maintaining the integrity of the insulation system at pipe hanger locations, such as Armaflex Armafix Insulation Pipe Hangers, are acceptable.
- H. Finish insulation at supports, protrusions, and interruptions.
- I. For pipe exposed in finished spaces below 8 feet above finished floor, finish with PVC jacket and PVC fitting covers.
- J. For piping exposed in mechanical rooms below 8 feet above finished floor, finish with PVC jacket and PVC fitting covers.
- K. All valves in insulated systems shall have valve stem extensions. Insulation installer shall notify the contractor and Owner if valves without stem extensions are encountered. All valves without stem extensions in areas where stem extensions are required shall be replaced.
- L. Provide insulation clearance and access to valves and fittings in hangers and from structure and other equipment. Insulation shall be continuous through all hangers and supports. Refer to Section 22 07 19.**

3.3 TOLERANCE

- A. Substituted insulation materials, where allowed, shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.4 GLASS FIBER INSULATION SCHEDULE

- A. Plumbing Systems

<u>PIPING SYSTEM:</u>	<u>PIPE SIZE:</u>	<u>MIN. THICKNESS:</u>
Domestic Hot Water Supply	1-1/4" & smaller	1"
Domestic Hot Water Supply	1-1/2" & larger	1-1/2"
Domestic Hot Water Recirc	1-1/4" & smaller	1"

3.5 CELLULAR FOAM INSULATION SCHEDULE

- A. Plumbing Systems

<u>PIPING SYSTEM:</u>	<u>PIPE SIZE:</u>	<u>MIN. THICKNESS:</u>
Domestic Cold Water	6" & smaller	1"

END OF SECTION 22 07 19

SECTION 22 10 00 - PLUMBING PIPING

1. GENERAL

1.1 SECTION INCLUDES

- A. Sanitary waste and vent pipe and fittings.
- B. Water pipe and fittings.
- C. Natural gas pipe and fittings.
- D. Flanges, unions, and couplings.
- E. Dielectric unions.
- F. Valves.
- G. Calibrated balance valves.

1.2 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
 - 1. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. References
- C. Submittals
 - 1. Product Data: For each type of product.
 - 2. Pipe and Valve Schedule: Include pipe and valve schedule that includes pipe system, pipe sizes, fittings, joints, valves, and accessories.
- D. Operation and maintenance manuals.
- E. Project record documents
 - 1. Record actual locations of valves.
- F. Delivery, storage, and handling

1.3 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with International Plumbing Code and International Fuel Gas Code.
- B. Provide lead-free materials (0.25% lead by weighted average) for applicable potable water meters, materials, piping, valves, fittings, backflow preventers, and other items in accordance with NSF/ANSI 61, including Appendix G.

- C. Provide lead-free materials (0.25% lead by weighted average) for applicable potable water faucets, faucet connectors, hoses, supply stops, and other items in accordance with NSF/ANSI 61, including Appendix 9-G.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.5 OPERATION AND MAINTENANCE DATA

- A. Refer to Section 22 05 00.

2. PRODUCTS

2.1 SANITARY WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. At Contractor's Option, use one of the following systems:
 - 1. Epoxy Coated Cast Iron Pipe and Fittings: ASTM A74, hub and spigot, service weight.
 - a. Approved manufacturers: Charlotte Pipe Edge HP, or approved equivalent.
 - b. Coatings shall meet the testing requirements of the EN877 coatings standard.
 - c. Pipe and fittings shall be third-party certified to the complete ASTM or CISPI standards.
 - d. Pipe and fittings shall have a 10 year warranty.
 - e. Joints shall be made by compression gaskets that conform to ASTM C564.
 - 1) Approved manufacturers: Charlotte Pipe Edge HP, or approved equal
 - a) Gasket material: Neoprene.
 - b) Temperature Range: -30 to 220 deg F.
 - f. Caulking Materials: ASTM B29, pure lead and oakum or hemp fiber.
- 2. PVC Pipe: ASTM D2665, solid-wall. Cellular core piping is not allowed.
 - a. Fittings: PVC, ASTM D2665, made to ASTM D3311, DWV patterns and to fit Schedule 40 pipe.
 - b. Joints: Solvent cement, ASTM D2564; and adhesive purple primer, ASTM F656.

2.2 SANITARY WASTE AND VENT PIPING, ABOVE GRADE

- A. Epoxy Coated Cast Iron Pipe and Fittings: ASTM A888 or CISPI 301, hubless, service weight.
 - 1. Approved manufacturers: Charlotte Pipe Edge HP, or approved equivalent.
 - 2. Coatings shall meet the testing requirements of the EN877 coatings standard.
 - 3. Pipe and fittings shall be third-party certified to the complete ASTM or CISPI standards.
 - 4. Pipe and fittings shall have a 10 year warranty.
 - 5. Couplings:

- a. Approved Manufacturer: Charlotte Edge HP Heavy-duty Couplings, or approved equivalent.
- b. Certifications and Standards:
 - 1) Meets ASTM C 1540 excluding gasket material
 - 2) Meets CSA B 602
 - 3) IAPMO and CSA Listed
- c. Materials Specification
 - 1) Screw: Type 305 AISI Stainless 3/8"
 - 2) Shield: Type 304 AISI Stainless steel, corrugated. Shield thickness 008".
 - 3) Bands: Type 304 AISI Stainless Steel
 - 4) Gasket: Primary Elastomeric Polymer is EPDM
 - 5) Screw housing: Type 304 AISI stainless steel
- d. Number of bands (by size):
 - 1) 1-1/2 – 4": 4
 - 2) 5-15": 6

B. The following systems may be used for **NON-PLENUM AREAS ONLY**:

- 1. PVC Pipe: ASTM D2665, solid-wall. Cellular core piping is not allowed. (Used only for fluid streams less than 120 Deg. F)
 - a. Fittings: PVC, ASTM D2665, made to ASTM D3311, DWV patterns and to fit Schedule 40 pipe.
 - b. Joints: Solvent cement, ASTM D2564; and adhesive purple primer, ASTM F656.

2.3 WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, hard drawn.

- 1. Fittings: ASME B16.18, cast bronze, or ASME B16.22, wrought copper and bronze.
- 2. Joints: Lead Free, ASTM B32, Alloy B solder, for piping 1-1/2" and smaller. AWS A5.8, BCuP silver braze, for piping 2" and larger.
 - a. Minimum 15% silver bearing filler material for copper-to-copper joints.
 - b. Minimum 45% silver bearing filler material for dissimilar metal joints.
- 3. Press-Connect Joints (4" and smaller):
 - a. Fittings: Fittings shall be Viega, Apollo, Nibco or approved equivalent. Fittings 1/2-inch thru 4-inch shall conform to ANSI B16.18 bronze or B16.22 copper and NSF/ANSI 61-G. Fittings 1/2-inch thru 2-inch shall be double press with Smart Connect feature and have either an EPDM, FKM or HNBR sealing element depending upon manufacturer-approved application guidelines. Fittings 2-1/2-inch thru 4-inch shall have a 420 stainless steel grip ring, separator ring, sealing element and Smart Connect feature. Sealing elements shall be verified for the intended use.

- 1) Only fittings that conform to NSF 61-pw with EPDM sealing element shall be installed in potable water systems.
- 2) All fittings shall be from the same manufacturer.

2.4 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Steel Press Fittings: Viega Megapress G, ASTM F3226, ASME B31, carbon steel cold press fitting system designed for fuel gas systems.

B. Drawn-Temper Copper Tube: Comply with ASTM B837, Type G.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
 - a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum O-rings, and spiral-wound metal gaskets.
 - b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.

2.5 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 Inches and Under:

1. Ferrous pipe: 150 psig malleable iron threaded unions.
2. Copper tube and pipe: 150 psig bronze unions with soldered joints.

B. Pipe Size Over 2 Inches:

1. Ferrous pipe: 150 psig forged steel slip-on flanges; 1/16 inch thick preformed neoprene gaskets.
2. Copper tube and pipe: 150 psig slip-on bronze flanges; 1/16 inch thick preformed neoprene gaskets.

C. Flanges, unions, and couplings used in potable water systems shall be lead-free construction. Refer to paragraph 1.3 REGULATORY REQUIREMENTS.

2.6 DIELECTRIC NIPPLE

A. Standard: IAPMO PS 66.

B. Electroplated steel nipple complying with ASTM F1545.

C. Pressure Rating and Temperature: 300 psig (2070 kPa) at 225 deg F.

D. End Connections: Male threaded.

- E. Lining: Inert and noncorrosive, propylene.
- F. Dielectric nipples used in potable water systems shall be lead-free construction. Refer to paragraph 1.3 REGULATORY REQUIREMENTS.

2.7 SWING CHECK VALVES

- A. Up to and including 2 Inches: Bronze swing disc, 125 psig working pressure.
- B. Over 2 Inches: Cast iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.
- C. Check valves used in potable water systems shall be lead-free construction. Refer to paragraph 1.3 REGULATORY REQUIREMENTS.

2.8 BALL VALVES

- A. Up to and including 4 inches: Bronze two piece body, chrome plated steel full-port ball, teflon seats and stuffing box ring, lever handle.
- B. Ball valves used in potable water systems shall be lead-free construction. Refer to paragraph 1.3 REGULATORY REQUIREMENTS.

2.9 STRAINERS

- A. Size 2 inch and Under: Screwed bronze body for 250 psig working pressure, Y pattern with 20-mesh stainless steel perforated screen.
- B. Size 2-1/2 inch and larger: Flanged cast iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
- C. Strainers used in potable water systems shall be lead-free construction. Refer to paragraph 1.3 REGULATORY REQUIREMENTS.

2.10 GAS VALVES

- A. Gas Cocks 2 Inch and Smaller: 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends.
- B. Gas Cocks 2-1/2 Inch and Larger: MSS SP-78; 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.
- C. Solenoid Valves: Aluminum body, 120 volts AC, 60 Hz, Class B continuous duty molded coils; NEMA 4 coil enclosure; electrically opened/electrically closed; dual coils; normally closed; UL and FM approved and labeled.
- D. Gas Line Pressure Regulators: Single stage, steel or aluminum jacketed, corrosion-resistant gas pressure regulators; with atmospheric vent, elevation compensator; with threaded ends for 2 inch and smaller, flanged ends for 2-1/2 inch and larger; for inlet and outlet gas pressures, specific gravity, and volume flow indicated.

2.11 CALIBRATED BALANCE VALVES

- A. Pre-Set Balance Feature. Valves to be designed to allow Installing Contractor to pre-set balance points for proportional system balance prior to system start-up in accordance with scheduled flow rates.
- B. Valve Design and Construction. All valves shall have a calibrated orifice or venturi section, two 1/4" threaded pressure tap ports with integral seals, and memory stop to retain the set position. Valves should be rated for 125 psig working pressure and 250 Deg. F maximum operating temperature.
- C. Valves used in potable water systems shall be lead-free construction. Refer to paragraph 1.3 REGULATORY REQUIREMENTS.
- D. Valves shall be selected based on flowrate, not on pipe size dimensions.
- E. Preformed Insulation. All valves to be provided with molded insulation to permit access for balance and read-out.
- F. Design Pressure/Temperature.
 - 1. 1/2" - 3" NPT connections 300 psig to 250 deg. F.
 - 2. 1/2" and 3/4" Sweat connections 200 psig at 250 deg. F.
 - 3. 4" flanged connections 125 psig at 250 deg. F.
- G. Calibrated balance valves to be ITT Bell and Gossett Model CB or equivalent.

2.12 DRAIN VALVES

- A. Equipped with hose adaptor fitting and cap.

3. EXECUTION

3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. General:

1. Install in accordance with manufacturer's instructions.
2. Provide non-conducting dielectric connections wherever jointing dissimilar metals. Only use dielectric nipples. Dielectric unions are not allowed unless approved by engineer of record.
3. Route piping in orderly manner and maintain gradient.
4. Install piping to conserve building space and not interfere with use of space.
5. Group piping whenever practical at common elevations.
6. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
7. Vent pipes shall extend minimum 12" above finish roof line or as required by code.
8. Provide clearance for installation of insulation and access to valves and fittings.
9. **Unless otherwise noted, do not install PVC pipe and fittings in return air plenums.**
10. Provide access where valves and fittings are not exposed.
11. Establish elevations of buried sanitary and storm piping outside the building to ensure not less than 3 ft of cover.
12. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
13. Prepare pipe, fittings, supports, and accessories not prefabricated, ready for finish painting.
14. Install bell and spigot pipe with bell end upstream.
15. Install valves with stems upright or horizontal, not inverted.
16. Install strainers in horizontal pipe or in vertical pipe such that flow is downward. Do not install strainers in vertical pipe with flow upward.
17. Install cast iron piping system according to CISPI Handbook.
18. Install copper tubing under building slab according to CDA's "Copper Tube Handbook." Install ball valve directly upstream of each floor slab penetration.
19. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.

3.4 APPLICATION

A. General:

1. Install unions downstream of valves at equipment or apparatus connections.
2. Install valves for shut-off and to isolate equipment, part of systems, vertical risers, and at every floor off of risers, even if not shown on plan.
3. Install ball valves for throttling, bypass, or manual flow control services.
4. Provide spring loaded check valves on discharge of water pumps.
5. Provide ball valve as flow control valve in water recirculating systems where indicated. Balance flow to maintain hot water at all plumbing fixtures.

B. Natural Gas Piping:

1. Provide plug valves in natural gas systems for shut-off service.
2. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
3. Outdoor Piping:
 - a. Paint piping, fittings, and equipment that are exposed to view from grade with factory-applied paint or protective coating. This includes but is not limited to: exterior metal piping, valves, service regulators, service meters and meter bars, and piping specialties.

- 1) Alkyd System: MPI EXT 5.1D.

- a) Prime Coat: Alkyd anticorrosive metal primer.
- b) Intermediate Coat: Exterior alkyd enamel matching topcoat.
- c) Topcoat: Exterior alkyd enamel semigloss
- d) Color: By Architect

3.5 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum or as indicated on drawings. Maintain gradients.
- B. Slope water piping and arrange to drain at low points.

3.6 PLUMBING PIPING PRESSURE TESTING

- A. Test for leaks and defects all new plumbing piping systems and parts of existing systems, which have been altered, extended or repaired. Submit copy of Pipe Pressure Test Log provided in section 22 05 00 for each section of piping tested. Refer to International Plumbing Code for general pipe pressure testing requirements (i.e., test pressure gauges, inspections, etc.).
- B. Leave uncovered and unconcealed all new, altered, extended, or replaced piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
- C. Repair all leaks and defects using new materials and retest all plumbing systems until satisfactory results are obtained.
- D. Natural Gas Piping System.
 - a. Test in accordance with International Fuel Gas Code, NFPA 54, and local utility requirements.

3.7 DISINFECTION OF WATER PIPING SYSTEMS

- 1. After water systems have been pressure tested and flushed, each system (including distribution system to building) shall be cleaned and disinfected per AWWA C651. Note that procedures shall require two (2) consecutive sets of acceptable samples taken at least 24 hours apart.
- 2. Take samples no sooner than 24 hours after flushing, from outlets and from water entry per AWWA 651, and analyze in accordance with AWWA C651.
- 3. Samples shall be subject to bacteriological testing by a recognized 3rd party testing agency. Send test reports to Owner for review. If unsatisfactory bacteriological results are found, the system shall be disinfected and retested again until satisfactory results are obtained.
- 4. For connections into existing building systems during renovations, the scope of the disinfection shall be discussed with the engineer and owner prior to commencing the cleaning process. In minor renovations to larger facilities, the disinfection may only be required for new piping. In major renovations, the entire system, including any existing piping will need to be cleaned.

END OF SECTION 22 10 00

SECTION 22 11 19 - PLUMBING SPECIALTIES

1. GENERAL

1.1 SECTION INCLUDES

- A. Expansion tanks.
- B. Cleanouts.
- C. Water hammer arresters.
- D. Floor drains and floor sinks.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
- B. References
- C. Submittals
 - 1. Product Data: For each type of product.
- D. Operation and maintenance manuals.
- E. Project record documents
- F. Delivery, storage, and handling

1.3 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with International Plumbing Code.
- B. Provide lead-free materials (0.25% lead by weighted average) for applicable potable water meters, materials, piping, valves, fittings, backflow preventers, and other items in accordance with NSF/ANSI 61, including Appendix G.
- C. Provide lead-free materials (0.25% lead by weighted average) for applicable potable water faucets, faucet connectors, hoses, supply stops, and other items in accordance with NSF/ANSI 61, including Appendix 9-G.

2. PRODUCTS

2.1 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Basis-of-Design Product: Amtrol THERM-X-TROL ST-30V-C

B. Alternative Manufacturers: Subject to compliance with requirements, provide one of the following:

1. Taco
2. Wessels Co.
3. Or equivalent.

C. Construction

1. Shell: ASME Approved Steel
2. Diaphragm/Bladder: Heavy Duty Butyl Compound
3. Liner – Diaphragm Models Only: Antimicrobial JIS Z 2801 Tested for Reduction of Legionella, Staphylococcus and E.coli
4. System Connection: Stainless Steel
5. Finish: Red Oxide Primer
6. Air Valve: Schrader Valve w/ EPDM Seats
7. Factory Precharge: 55 PSIG (3.8 bar)

D. Performance

1. Max. Operating Temperature: 200° F (93° C)
2. Max. Working Pressure: Available 125 PSIG (8.3 bar) through 300 PSIG (21 bar)
3. Warranty: 3-Year Limited

E. Application

1. For use in closed, potable hot water systems to control pressure buildup.
2. Meets all ASME Section VIII, Division 1 code standards.
3. Provide with optional sight glass.

2.2 CLEANOUTS

A. Exterior Surfaced Areas: Round or Square cast nickel bronze access frame and non-skid cover.

B. Interior Finished Floor Areas: cast iron body and frame, nickel bronze top to accommodate the following floor finishes as required:

1. Exposed rim type with recess to receive tarrazzo or resilient floor finish.
2. Exposed finish type with standard mill finish.
3. Exposed flush type with standard scored or abrasive finish.
4. Concealed undercarpet flush type with mill finish and carpet marker.

C. Interior Finished Wall Areas: Line type with cast iron body and round gasket cover and round stainless steel access cover secured with machine screw.

D. Interior Unfinished Accessible Areas: Caulked or threaded type.

2.3 WATER HAMMER ARRESTERS

A. Standard: ASSE 1010 or PDI-WH 201.

- B. Type: Metal bellows or copper tube with piston.
- C. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F. Size per manufacturer recommendations.

2.4 FLOOR DRAINS AND FLOOR SINKS

- A. Refer to Plumbing Fixture Schedule for required product information.
- B. Barrier-type trap seal protection device: SureSeal or equivalent waterless inline drain trap seal. HDPE (High Density Poly Ethylene) housing with heavy duty silicone diaphragm and soft EPDM rubber sealing gasket. Floor rating ASSE 1072 AF GW.

2.5 OTHER SPECIALTIES

- A. Refer to Plumbing Fixture Schedule for required product information.

3. EXECUTION

3.1 PREPARATION

- A. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.2 INSTALLATION

- A. All Plumbing Specialties:
 - 1. Install in accordance with manufacturer's instructions.
- B. Cleanouts:
 - 1. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
 - 2. Encase exterior cleanouts in concrete flush with grade.
- C. Water Hammer Arrestors:
 - 1. Install water hammer arrestors complete with accessible isolation valve according to PDI-WH 201 and as shown on drawings.
- D. Floor Drains / Floor Sinks:
 - 1. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 2. Position floor drains for easy access and maintenance.

3. Unless dimensioned on drawings, location of drains shown on plans are approximate. Installing contractor shall be responsible for coordinating final location with other trades to ensure proper coordination with other building elements including but not limited to: structural members (above/below grade), owner-furnished equipment, walls, and bathroom partitions. Upon identifying a coordination conflict, the contractor shall notify the Engineer of Record by way of RFI with suggested location for drain and obtain approval of new location. No additional compensation shall be provided by Owner for lack of coordination.
4. Set floor drains 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 1/4-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.
5. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
6. Install barrier-type trap seal protection device in all floor drains and sinks, unless noted otherwise on plans.

3.3 TESTING

- A. Test and certify all backflow preventers for proper operation. Testing agent shall be Grade VI Water Operator.
 1. Test shall be completed within 30 days of installation or Substantial Completion, whichever is later.

END OF SECTION 22 11 19

SECTION 22 21 23 - PLUMBING PUMPS

1. GENERAL

1.1 SECTION INCLUDES

- A. In-line wet rotor circulation pumps for potable water systems.

1.2 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING:

A. References.

1. HI - Hydraulic Institute.
2. ANSI - American National Standards Institute.
3. OSHA - Occupational Safety & Health Administration.
4. ASHRAE – American Society of Heating, Refrigeration and Air-Conditioning Engineers.
5. NEMA - National Electrical Manufacturers Association.
6. UL - Underwriters Laboratories.
7. ETL - Electrical Testing Laboratories.
8. CSA - Canadian Standards Association.
9. NEC - National Electric Codes.
10. ISO - International Standards Organization.
11. IEC - International Electrotechnical Commission.
12. ASME – American Society of Mechanical Engineers.

B. Performance requirements.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. UL Compliance: UL 778 for motor-operated water pumps.
3. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

C. Submittals.

1. Submit each item in this article according to the Conditions of the Contract, Division 1 Specification Sections, and requirements outlines in Specification Section 22 05 00.
2. Submit manufacturer's installation instructions under provisions of General Conditions and Division 1.
 - a. Operation and Maintenance Data: Include installation instructions, assembly views, and replacement parts lists.
 - b. Under provisions of commissioning documentation, testing of pumps, as well as training of owner's operation and maintenance personnel may be required in cooperation with the commissioning consultant.
3. Product Data including published performance curves and rated capacities of selected model, shipping weights, furnished specialties, and accessories. Indicate pump's operating point on curves.
4. Complete Package information:

- a. System summary sheet (where applicable)
- b. Shop drawing indicating dimensions, required clearances and location and size of each field connection
- c. Power and control wiring diagram
- d. System profile analysis including pump curves, system curve, and variable speed pump curves (where applicable)
- e. Pump data sheets - Rated capacities of selected models and indication of pump's operating point on curves.
- f. Submittals on furnished specialties and accessories
- g. Submittals must be specific to this project. Generic submittals will not be accepted
- h. Warranty information.

5. Hanging and support requirements should follow the recommendation.

D. Qualifications.

E. Delivery, storage and handling.

- 1. Deliver materials to the site in such a manner as to protect the materials from shipping and handling damage. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Materials which could be damaged by the elements should be packaged in such a manner that they could withstand short-term exposure during transportation.
- 2. Store materials in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.
- 3. Use all means necessary to protect equipment before, during, and after installation.
- 4. All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Engineer.

2. PRODUCTS

2.1 IN-LINE CIRCULATION PUMPS FOR POTABLE WATER SYSTEMS

- A. See Plumbing Pumps Schedule on drawings for performance requirements.
- B. Basis-of-Design Product: Pumps shall be a Grundfos UPS series or equivalent pump meeting all specifications illustrated on the plans and in accordance with the following specifications:
- C. Alternative Manufacturers: Subject to compliance with requirements, provide one of the following:
 - 1. Bell & Gossett
 - 2. Taco
 - 3. Or equivalent.
- D. Technical:
 - 1. Speed Number: 3
 - 2. Rated flow: 11.1 US gpm
 - 3. Max flow: 25.1 US gpm
 - 4. Rated head: 8.042 ft

5. Maximum head: 18.05 ft
6. Approvals: UL, CSA
7. Pump with built-in isolating and non-return valves

E. Materials

1. Pump housing: Stainless steel, AISI 304, EN 1.4308
2. Impeller: Composite, PES+30% GF

F. Liquid: Water

G. Electrical Data:

1. Power input in speed 1: 0.07778 HP
2. Power input in speed 2 77 W
3. Max. power input: 87 W
4. Main frequency: 60 Hz
5. Rated voltage: 1 x 115 V
6. Current in speed 1: 0.53 A
7. Current in speed 2: 0.69 A
8. Current in speed 3: 0.75 A
9. Capacitor size – run: 10 µF/180 V
10. Number of poles: 2
11. Insulation class (IEC 85): F
12. Ex-protection standard: CONTACT
13. Thermal protec: Impedance protected

H. Weight: Gross weight = 5.79 lb

I. Installation:

1. Maximum ambient temperature: 104 °F
2. Ambient max at 176°F liquid: 176 °F
3. Maximum operating pressure: 145.04 psi
4. Type of connection: 1 1/4" NPSM, S.S. Union
5. Pipe connection: 1 1/4" NPSM
6. Pressure rating for connection: PN 10
7. Port-to-port length: 5 15/16 in
8. Terminal box position: 9H

3. EXECUTION

3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install pump using allowable orientation noted in manufacturer's instruction.

- C. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- D. Reduction from line size to pump connection size shall be made with eccentric reducers attached to the pump with tops flat to allow continuity of flow and to avoid air pockets.
- E. Provide line sized shut-off valve and pump suction fitting flexible connection on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.
- F. Provide temperature and pressure gauges where and as detailed or directed.
- G. Install valves that are the same size as piping connected to pumps.
- H. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- I. All piping shall be brought to equipment and pump connections in such a manner so as to prevent the possibility of any load or stress being applied to the connections or piping.

3.3 ELECTRICAL CONNECTIONS

- A. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instruction and per applicable state, federal, and local codes.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring between temperature controllers and devices.
- C. Power and control wiring shall run in separate conduit.

3.5 START-UP AND COMMISSIONING

- A. Start-up pump in accordance to manufacturer written instructions.
- B. Do not start pump until the system has been filled and vented. Air should be vented from the system by means of an air vent located at a high point in the system. The system must be completely vented prior to pump operation. Do not run circulators dry. Pump operation without water circulation could result in pump and motor damage.
- C. Coordinate pump testing, adjusting and balancing with Balancing Contractor. Complete additional preliminary work required by Balancing Contractor.

END OF SECTION 22 21 23

SECTION 22 30 00 - PLUMBING EQUIPMENT

1. GENERAL

1.1 SECTION INCLUDES

- A. Domestic water heaters.
- B. Thermal mixing valves.

1.2 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING GUIDELINES

- A. Submittals
 - 1. Product Data: For each type of product.
- B. Closeout Submittals:
 - 1. Operation and Maintenance Data: For all specified and/or scheduled plumbing equipment to include in operation and maintenance manuals.

1.3 QUALITY ASSURANCE

- A. See Section 22 05 00.
- B. Perform Work in accordance with State and Local standards.
- C. Ensure products and installations of specified products are in conformance with recommendations and requirements of the following organizations:
 - 1. National Sanitation Foundation (NSF).
 - 2. American Society of Mechanical Engineers (ASME).
 - 3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
 - 4. National Electrical Manufacturers' Association (NEMA).
 - 5. Underwriters Laboratories (UL).

1.4 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. PRODUCTS

2.1 Refer to Plumbing Equipment Schedules for performance requirements.

2.2 DOMESTIC NATURAL GAS WATER HEATER

- A. Basis-of-Design Product: A.O. Smith FCG-100

B. Alternative Manufacturers: Subject to compliance with requirements, provide one of the following:

1. Lochinvar Corporation.
2. PVI Industries, LLC.
3. Or equivalent.

C. Technical Specifications:

1. Nominal Gallon Capacity: 98 Gallons
2. Rated Storage Volume: 95 Gallons
3. UEF: 0.58
4. Thermal Efficiency: 80%
5. Maximum BTUs: 75,100
6. Fuel Source: Natural Gas
7. Limited Tank Warranty: 6 Years
8. Limited Parts Warranty: 6 Years
9. T&P Relief Valve: Yes
10. Water Connection Size: 1.25"
11. Emissions Low NOx
12. First Hour Rating: 170 Gallons
13. ASME Certified: No
14. Blanket Included: No
15. Destination Country: US
16. Flue Diameter: 5.00
17. Ignition Type: Pilot with Piezo Igniter
18. Installation Type: Indoor
19. Recovery Rise at 90°F: 81 deg F
20. Shipping Height: 68.5"
21. Shipping Length: 33.5"
22. Shipping Width: 30.5"
23. Side Loop: No

D. Dimension & Venting

1. Type: Water Heater
2. Height: 65"
3. Diameter: 27.75 in."
4. Shipping Weight: 340 lbs
5. Vent Type: Atmospheric Vent

2.3 THERMAL MIXING VALVES

A. Manufacturer: Subject to compliance with scheduled requirements, provide product by one of the following:

1. Leonard Valve Company TM-820B-LF-DT (Basis of Design)
2. Powers
3. Armstrong International, Inc.
4. Or equivalent.

- B. Mixing Valve shall comply with National Low Lead Laws @< .25% Lead
- C. Mixing Valve shall be 1017 certified
- D. Solid bimetal thermostat Directly linked to valve porting to control the intake of hot and cold water and compensate for supply temperature and pressure fluctuations.
- E. Not dependent upon a circulating pump to achieve minimum flow performance.
- F. The valve shall maintain temperature with 0.5gpm flow from the domestic hot water loop when properly installed near the hot water source with continuously operating recirculation pump.
- G. Mixing valve shall:
 - 1. Have 1" inlet and 1 ¼" outlet connections
 - 2. Flow 1-89 GPM (3.8 – 337 l/min)
 - 3. Have temperature range of 60-180 degrees Fahrenheit
 - 4. Have integral stop/check valves
 - 5. Have integral wall support for easy mounting
 - 6. Have locking temperature regulator handle to prevent accidental movement
 - 7. Have color coded dial thermometer
 - 8. Be complete with inlet manifold piping
 - 9. Have outlet ball valves on each valve as part of the assembly
- H. Finish
 - 1. Rough finish
- I. Options
 - 1. Inlet Thermometers
 - 2. Test Connection

3. EXECUTION

3.1 DOMESTIC NATURAL GAS WATER HEATER INSTALLATION

- A. Install water heater in accordance with manufacturer's instructions.
- B. Install unit with manufacturer recommended clearances for service.
- C. Pipe relief valves and drains to nearest floor drain.
- D. Where installing piping adjacent to domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.2 THERMAL MIXING VALVE INSTALLATION

- A. Install thermal mixing valve in accordance with manufacturer's instructions.

A. Equipment Mounting:

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. For floor-supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Install thermal mixing valve and fittings furnished by equipment manufacturer but not specified to be factory installed.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Provide start up reports

B. Thermal mixing valves

1. Follow manufacturer's recommendations for start-up and adjust outlet temperatures from valves to scheduled value.
2. Adjust circulation lines to scheduled flow and verify presence of scheduled tempered water at all fixtures.

C. Domestic water heater(s).

1. Follow manufacturer's recommendations for start-up and adjust outlet temperatures from water heater(s) to scheduled value.
2. Fill domestic heater(s) with water.
3. Charge domestic water expansion tanks with air.

4. Adjust circulation lines to scheduled flow and verify presence of 'hot' water at all fixtures.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain plumbing equipment.

END OF SECTION 22 30 00

SECTION 22 40 00 - PLUMBING FIXTURES

1. GENERAL

1.1 SECTION INCLUDES

- A. Plumbing fixtures.
- B. Installation requirements of plumbing fixtures scheduled in Plumbing Fixture Schedule.
- C. Plumbing fixture carriers.

1.2 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. PMMA: Polymethyl methacrylate; also known as "acrylic."
- C. Standard-Efficiency Flush Volume: 1.6 gal per flush.
- D. High-Efficiency Flush Volume: 1.28 gal or less per flush.
- E. WaterSense Fixture: Water closet and/or flushometer valve/tank certified by the EPA to meet the WaterSense performance criteria.

1.3 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING GUIDELINES

- A. References
- B. Submittals
 - 1. Product Data:
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for plumbing fixtures.
 - b. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Shop Drawings:
 - a. Plans, elevations, sections, and mounting/attachment details.
 - b. Details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Quality Assurance
- D. Delivery, Storage and Handling
- E. Closeout Submittals

F. Extra Materials

1. Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - a. Faucet Washers and O-Rings: Equal to [10] percent of amount of each type and size installed, but no fewer than **one** of each type.
 - b. Faucet Cartridges and O-Rings: Equal to [5] percent of amount of each type and size installed, but no fewer than **one** of each type.
 - c. Shower Valve Washers and O-Rings: Equal to [10] percent of amount of each type and size installed, but no fewer than **one** of each type.
 - d. Shower Valve Cartridges and O-Rings: Equal to [5] percent of amount of each type and size installed, but no fewer than **one** of each type.
 - e. Flushometer-Valve Repair Kits: Equal to [10] percent of amount of each type installed, but no fewer than **one** of each type.

1.4 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings and instructed by the manufacturer.
- B. Confirm that millwork is constructed with adequate provision for the installation of countertop lavatories and sinks.

2. PRODUCTS

2.1 PLUMBING FIXTURES

- A. Refer to Plumbing Fixture Schedule for all required product information.

2.2 PERFORMANCE REQUIREMENTS

- A. Lavatory faucets, sink faucets, shower valves, and wash fountain spray heads and faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Comply with ANSI/ISEA Z358.1 for emergency plumbing fixtures including third-party certification of fixtures.
- C. Comply with ASSE 1071 for temperature-actuated mixing valves for plumbed emergency fixtures.
- D. Comply with ASME A112.18.1/CSA B125.1 for water-supply fittings.
- E. Comply with ASME A112.18.2/CSA B125.2 for plumbing waste fittings.
- F. Comply with NSF 61 and NSF 372 for fixture materials that will be in contact with potable water.
- G. Comply with requirements in ICC A117.1 for plumbing fixtures for people with disabilities.

- H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 PLUMBING FIXTURE CARRIERS

- A. All wall mounted fixtures such as urinals, water closets, lavatories, drinking fountains, electric water coolers, etc. shall be installed with compatible carriers. All carriers shall be commercial or industrial grade and shall be suitable for the fixture served, space available and building construction. All carriers shall extend to the floor and be anchored into the slab.
- B. Water closet carriers shall be ultra heavy-duty type, rated for a minimum of 750 lbs.

3. EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Verify that electric power is available and of the correct characteristics.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install each fixture with trap with 2 slip joints, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid or flexible supplies to fixtures with stops, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with scheduled wall supports or wall carriers and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant, color to match fixture.

3.4 INSTALLATION OF PIPING CONNECTIONS

- A. Connect plumbing fixtures with water supplies and soil, waste, and vent piping. Use size fittings required to match plumbing fixtures.

- B. Comply with water piping requirements specified in Section 22 10 00 "Plumbing Piping."
- C. Comply with soil, waste, and vent piping requirements specified in Section 22 10 00 "Plumbing Piping."
- D. Install protective-shielding pipe covers and enclosures on exposed supplies and waste piping of accessible plumbing fixtures. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."
- E. Where installing piping adjacent to water closets and urinals, allow space for service and maintenance.

3.5 WATER CLOSET INSTALLATION

- A. Water-Closet Installation:
 - 1. Install level and plumb according to roughing-in drawings.
 - 2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1. Coordinate exact locations with drawings.
 - 3. Where installing piping adjacent to water closets, allow space for service and maintenance.
- B. Support Installation:
 - 1. Use carrier supports with waste-fitting assembly and seal.
 - 2. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.
- C. Flushometer-Valve Installation:
 - 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
 - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 - 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
 - 4. Install actuators in locations that are easy for people with disabilities to reach.
- D. Install toilet seats on water closets.
- E. Wall Flange and Escutcheon Installation:
 - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- F. Joint Sealing:
 - 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to water-closet color.

3.6 LAVATORY AND SINK INSTALLATION

A. Lavatory and Sink Installation:

1. Install lavatories and sinks level and plumb according to roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted lavatories and sinks.
3. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1. Coordinate exact locations with drawings.
4. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.
5. Install trap and waste piping on each drain outlet of each lavatory to be connected to sanitary drainage system.
6. Seal joints between lavatories/sinks, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.
7. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks.
8. Install water-supply piping with stop on each supply to each faucet.
 - a. Exception: Use ball, gate, or globe valves if supply stops are not specified with lavatory/sink.
 - b. Install stops in locations where they can be easily reached for operation.

3.7 SHOWER INSTALLATION:

1. Assemble shower components in accordance with manufacturers' written instructions.
2. Install showers level and plumb in accordance with roughing-in drawings.
3. Install ball valves in water-supply piping to the shower if supply stops are specified with the shower valve. Install valves in locations that are accessible for ease of operation.
4. Install shower flow-control fittings with specified maximum flow rates in shower arms.
5. Set shower basins in leveling bed of cement grout.
6. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.
7. Seal joints between showers, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.8 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.9 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning plumbing fixtures, fittings, and controls.
- C. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow.
- D. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.10 FIELD QUALITY CONTROL

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: Operate units to confirm proper unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.11 CLEANING AND PROTECTION

- A. Directly prior to project turnover, clean plumbing fixtures and fittings with manufacturers' recommended cleaning methods and materials.
- B. Inspect and repair damaged finishes. Replace any fixtures unable to be repaired to the satisfaction of the Architect or Owner.
- C. Install protective covering for installed water closets, urinals, and fittings.
- D. Do not allow use of plumbing fixtures for use during construction unless approved in writing by Owner.

END OF SECTION 22 40 00

SECTION 23 00 00 - MECHANICAL DEMOLITION

1. GENERAL

1.1 SECTION INCLUDES

- A. Demolition may include all mechanical systems.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
- B. References.
- C. Submittals.
- D. Project record documents.

2. PRODUCTS

2.1 MATERIALS

- A. Provide all materials necessary for demolition work.

3. EXECUTION

3.1 PREPARATION

- A. Coordinate utility service outages with utility company and schedule utility to locate buried services.
- B. Provide temporary connections to maintain existing system in service during construction.
- C. When Contractor elects to perform work on energized equipment, use personnel experienced in such operations.
- D. Beginning of demolition means contractor accepts existing conditions.

3.2 DEMOLITION

- A. Connect equipment which is existing and is to remain to the new system as required to maintain its proper operation.
- B. Maintain access to existing mechanical installations which remain active. Modify installation or provide access as appropriate.

3.3 SCHEDULING AND PHASING

- A. Prior to the start of any demolition work within the building, provide the A/E and Owner a schedule of phased selective demolition for all mechanical demolition at the site.
- B. Provide the following information for the schedule:
 - 1. Number of phases of demolition.
 - 2. Limits of each phase.
 - 3. Dates of start/finish demolition by phase.
 - 4. Critical dates for disruptions in chilled water, hot water, steam or other mechanical
 - 5. systems.
 - 6. Dates and duration of temporary measures to maintain occupancy in adjacent areas.
- C. Coordinate the mechanical demolition schedule with all aspects of demolition under other divisions of the specifications.

END OF SECTION 23 00 00

SECTION 23 05 00 - BASIC HVAC REQUIREMENTS

1. GENERAL

1.1 SECTION INCLUDES

- A. This section describes Basic Mechanical Requirements to provide for a complete installation of all mechanical systems for this project. This section shall apply to all other Division 23 specification sections as well as all work shown on the drawings.
- B. It is the intent of the Mechanical Division of the Specifications that all mechanical work specified herein be coordinated as required with the work of all other Divisions of the Specifications and Drawings so that all installations operate as designed.
- C. All systems shall be completely assembled, tested, adjusted and demonstrated to be ready for operation to the satisfaction of the Owner's representative.
- D. The Contractor shall note that, in some cases, piping as shown on the Drawings provide general location and routing information only. The Contractor shall be responsible for providing interference-free systems with proper clearance to facilities and equipment.
- E. Where the word "provide" is used, it shall mean "furnish and install" unless otherwise noted or specified.
- F. Note that the words "mechanical" and "plumbing" are used interchangeably throughout the Division 22 and 23 specification sections.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section and all other sections of Division 23.

1.3 DESCRIPTION OF WORK

- A. The work included under this section consists of providing all labor, materials, supervision, and construction procedures necessary for the installation of the complete mechanical systems required by these specifications and/or shown on the drawings of the contract.
- B. The Contract Drawings are shown in part diagrammatic intended to convey the scope of work, indicating the intended general arrangement of equipment, piping, ductwork, etc.

1.4 QUESTIONS OF INTERPRETATION

- A. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect/Engineer for clarification. Any definitive interpretation or clarification of the contract documents will be published by addenda, properly issued to each person holding documents, prior to the bid date. Verbal interpretation or explanation not issued in the form of an addendum shall not be considered part of the bidding documents. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.
- B. The Architect/Engineer shall be the sole judge regarding interpretations of conflicts within contract documents.

1.5 CONTRACT DOCUMENT DISCREPANCIES

- A. If any ambiguities should appear in the contract documents, the Contractor shall request clarification from the Architect/Engineer before proceeding with the work. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a manner satisfactory to the Architect/Engineer. Should a conflict occur within the contract documents, the Contractor is deemed to have estimated the more expensive way of doing the work unless a written clarification from the Architect/Engineer was requested and obtained before submission of bid.
- B. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of three-dimensional objects. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies should be identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
- C. The Contractor shall follow the drawings in laying out work and verify clearances for the installation of the materials and equipment based on the dimensions of actual equipment furnished. Whenever a question exists as to the exact intended location of materials or equipment, obtain instructions from the Architect/Engineer before proceeding with the work.
- D. If there is a conflict between manufacturer's recommendations and the Contract Documents, the manufacturer's recommendations shall govern with no additional cost to the Owner.

1.6 PERMITS

- A. The Contractors shall familiarize themselves with all requirements regarding all permits, fees, etc., and shall comply with them. All permits, licenses, inspections and arrangements required for the work shall be obtained by the Contractor at his expense.
- B. All utilities shall be installed in accordance with the local rules and regulations and all charges shall be paid by the Contractor.

1.7 QUALITY ASSURANCE

- A. Installers shall have at least 2 years of successful installation experience on projects with mechanical installation work similar to that required by the project. All equipment and materials shall be installed in a neat and workmanlike manner and shall be aligned, leveled, and adjusted for satisfactory operation, unless noted otherwise in other mechanical sections.
- B. Manufacturer of equipment and materials must be regularly engaged in the manufacture of the specified equipment and material with similar construction and capacities and whose products have been in satisfactory use in similar service for not less than five (5) years, unless noted otherwise in other Mechanical Sections.
- C. Qualify welding processes and operators for structural steel according to AWS D1.1. "Structural Welding Code - Steel.
- D. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
- E. Comply with provisions of ASME B31 Series "Code for Pressure Piping", including all addenda.
- F. Contractor signed welder certificate(s) shall be submitted. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current. A record shall be maintained on the job site showing the date and results of qualification tests for each welder employed on the job. One certified copy of the qualification test for each welder so employed shall be furnished to the Owner's representative.
- G. For all the refrigerant work/service required by this project, all refrigerant technicians shall be EPA/ASHRAE 34 certified for corresponding classification type I, II, III and/or IV.

1.8 REFERENCES

- A. The design, manufacture, testing, and method of installation of all equipment and materials furnished under the requirements of this specification shall conform to the following as applicable:
 - 1. Safety and Health Regulations for Construction.
 - 2. Occupational Safety and Health Standards, National Consensus Standards and Established Federal Standards.
 - 3. ABMA - American Boiler Manufacturers Association.
 - 4. ACCA - Air Conditioning Contractors of America.
 - 5. ACGIH - American Conference of Governmental Industrial Hygienists.
 - 6. ADC - Air Diffusion Council.
 - 7. AGA - American Gas Association.
 - 8. AIHA - American Industrial Hygiene Association.
 - 9. AMCA - Air Movement and Control Association.
 - 10. ANSI - American National Standards Institute.
 - 11. ARI - Air-Conditioning and Refrigeration Institute.
 - 12. ASA - Acoustical Society of American.
 - 13. ASHRAE - American Society of Heating, Refrigerating, and Air-Conditioning Engineers.
 - 14. ASME - The American Society of Mechanical Engineers.
 - 15. ASTM - American Society of Testing and Materials.
 - 16. CAGI - Compressed Air and Gas Institute.
 - 17. CTI - Cooling Tower Institute.
 - 18. EJMA - Expansion Joint Manufacturers Association.
 - 19. ETL - Engineering Tests Laboratory.

20. HEI - Heat Exchange Institute.
21. HI - Hydraulic Institute.
22. HYD I - Hydronics Institute.
23. ICBO - International Conference of Building Officials.
24. ICC – International Code Council.
25. NEBB - National Environmental Balancing Bureau.
26. NEC - National Electrical Code.
27. NEMA - National Electrical Manufacturers Association.
28. NFPA - National Fire Protection Association.
29. NSF - National Sanitation Foundation.
30. SAE - Society of Automatic Engineers.
31. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
32. TEMA - Tubular Exchanger Manufacturers Association.
33. UL - Underwriters Laboratories, Inc.
34. International Plumbing Code.
35. International Mechanical Code.
36. Other governing, state, and local codes that apply.

1.9 SUBMITTALS

- A. General: Follow the procedures specified in Division 1 Sections "General Conditions" and "Special Conditions".
- B. The Architect/Engineer's review of submittals including any corrections or comments made on the shop drawings during the review process, do not relieve Contractor from compliance with requirements of the Contract Documents. The review is only a review of general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication process and techniques of construction, coordinating his work with that of all other trades, and performing his work in a safe and satisfactory manner. The Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data or samples by the Architect/Engineer's review of those drawings.
- C. No portion of the work requiring submission of a shop drawing, product data or sample shall be commenced until the submittal has been reviewed by the Architect/Engineer. All such portions of the work shall be in accordance with reviewed submittals and the associated manufacturer recommendations.
- D. Shop drawings shall include the minimum following information as applies. Additional specific information required is outlined in other Mechanical Sections.
 1. All equipment items shall be marked with the same item number as used on drawings or schedules.
 2. Certified performance and data with system operating conditions indicated. All coil, fan, energy recovery, terminal unit, sound attenuation, and pump performance data shall be computer generated.
 3. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicating size, weights (shipping, installed, and operating), furnished specialties and accessories; and installation and start-up instructions.
 4. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loading, required clearances, and methods of assembly of components.

5. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to electrical equipment. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of electrical equipment and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
6. Maintenance Data: Submit maintenance data and parts list for each mechanical equipment, control and accessory; including "troubleshooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 1.

E. Provide separate shop drawing submittals for the following items:

1. Section 23 05 00:

Submittal Requirement:	Date Submitted:
HVAC permits	
HVAC licenses	
EPA/ASHRAE 34 refrigeration certification for type I, II, III&/ or IV services	
Welding certificates	
Warranties	
As-built documents	
Piping pressure test logs	
Operation and maintenance manuals	
Close-out / walk-through documentation	
Owner training documentation	

2. Section 23 05 29:

Submittal Requirement:	Date Submitted:
HVAC hangers and supports	

3. Section 23 05 53:

Submittal Requirement:	Date Submitted:
HVAC identification materials	

4. Section 23 05 93:

Submittal Requirement:	Date Submitted:
Pre-balancing conference meeting notes	
Pre-balancing field deficiency report	
Draft TAB report	
Final TAB report	

5. Sections 23 07 13

Submittal Requirement:	Date Submitted:
Ductwork insulation materials and insulation schedule	

6. Sections 23 09 93:

Submittal Requirement:	Date Submitted:
Control drawings	
Control materials and equipment	
Sequence of operation	
Points list	

7. Section 23 31 13:

Submittal Requirement:	Date Submitted:
Ductwork material and schedule	
Flexible ductwork	
Low pressure manufactured ductwork fittings	
Ductwork hangers, sealants, tapes, etc.	
Ductwork connection systems	

8. Section 23 33 00:

Submittal Requirement:	Date Submitted:

Submittal Requirement:	Date Submitted:
Dampers	
Flexible duct connections	
Duct access doors	
Duct test hole plugs	
Volume control dampers	

9. Section 23 34 23:

Submittal Requirement:	Date Submitted:
Power ventilators	

10. Section 23 37 00:

Submittal Requirement:	Date Submitted:
Air outlets and inlets	

11. Section 23 74 16:

Submittal Requirement:	Date Submitted:
Packaged Rooftop Unit	

1.10 SUBSTITUTIONS

- A. All proposals shall be based on providing and installing the materials or items of equipment as shown on the Contract Documents. The Contractor's options in selecting materials and equipment are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects.
- B. Where the terms "or equivalent" is used, the Contractor may substitute alternate equipment, materials, etc. subject to review by the Architect/Engineer and the Owner's representative during the submittal phase of the project.
- C. Where the term "or approved equivalent" is used, the Contractor may not substitute alternate equipment, materials, etc. unless requesting approval at least ten (10) days before the bid date. Notifications of any such approvals by the Architect/Engineer shall only be made in writing by Addendum.

- D. Where the term "no equivalent" is used, the Contractor must provide the specified or scheduled equipment, materials, etc.
- E. Proposed substitutions will be judged on the basis of quality, capacity, performance, features, physical size, and appearance. The reputation of the manufacturer, delivery time requirements, and the availability of repair or replacement parts may also be considered.
- F. The Architect/Engineer shall be the sole and final judge as to the suitability of substitution items.
- G. If a substitution is approved, the Contractor shall bear the total cost of all changes due to substitution. These costs may include additional compensation to the Architect/Engineer for redesign and evaluation services, increased cost of work by the Owner or other Contractors, and similar considerations.
 - 1. If an approved substitution differs from the specified item in terms of power requirements, dimensions, capacities, and ratings, the associated mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are to be increased accordingly, but all recommended manufacturer clearances, etc., are to be maintained within the allotted mechanical spaces. No additional costs will be approved for these modifications. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

1.11 WARRANTY

- A. Refer to the General Conditions section of this Specification for general warranty requirements and information. Additional warranty requirements are specified in subsequent Mechanical Sections.

1.12 CLOSE OUT AND OPERATION INSTRUCTIONS

- A. Operate each system and item of equipment in a test run of appropriate duration, but no less than 7 days, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance.
- B. Systems shall not be used for temporary operation during construction without written approval from the Architect/Engineer. If approved and used during construction, all systems must be properly maintained and operated according to manufacturer recommendations. Immediately prior to turnover to the Owner, the contractor shall perform all necessary preventative maintenance according to all manufacturer recommendations, including, but not limited to, filter replacement, strainer cleaning, belt adjustment, etc.
- C. Any system placed in temporary operation for testing or for the convenience of the Contractor during construction shall be properly maintained and operated by the Contractor.
- D. All systems shall be protected against freezing, flooding, corrosion or other forms of damage prior to acceptance by the Owner.
- E. Material or equipment damaged, shown to be defective or not in accordance with the Specifications shall be repaired or replaced to the satisfaction of the Owner's representative.
- F. All tests shall be made after notification to and in the presence of the Owner's representative.

- G. Before starting up any system, each piece of equipment comprising any part of the system shall be checked for proper lubrication and any other condition which may cause damage to the equipment or endanger personnel.
- H. After systems have been demonstrated to be satisfactory for 7 consecutive days and ready for permanent operation, all permanent pipe line strainers shall be cleaned, valve and packings properly adjusted, lubrication checked and replenished if required. Temporary piping, etc. shall be removed and openings restored in a permanent manner acceptable to the Owner's representative.
- I. Conduct a walk-through instruction seminar for the Owner's personnel pertaining to the continued operation and maintenance of mechanical equipment and systems. Explain the identification system, maintenance requirements, operational diagrams, temperature control provisions, sequencing requirements, security, safety, efficiency and similar features of the systems. Walk through must be documented as to those attending and subjects covered. Walk through document(s) shall be signed and dated by the contractor's representative and the owner's representative.
- J. At the time of substantial project completion, turn over the prime responsibility for operation of the mechanical equipment and systems to the Owner's operating personnel. Until the time of final acceptance, provide full time operating personnel, who are completely familiar with the work, to consult with and continue training the Owner's personnel.
 - 1. If any systems are operated prior to substantial completion, the contractor shall perform all necessary preventative maintenance according to all manufacturer recommendations.

1.13 AS-BUILT DOCUMENTS

- A. Prepare as-built documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in above, indicate the following installed conditions:
 - 1. The Mechanical Contractor shall provide the Owner with as-built drawings for ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units and indicate all devices requiring periodic maintenance or repair.
 - 2. All mechanical systems as described in the Specifications and/or shown on the drawings.
 - 3. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 23 Section "Mechanical Identification." Indicate actual inverts and horizontal locations of underground piping.
 - 4. Equipment/material locations (exposed and concealed), dimensioned from prominent building lines.

1.14 MAINTENANCE MANUALS

- A. Per International Energy Code, paragraphs 803.3.8 and 803.3.8.3, Prior to the issuance of a certificate of occupancy, the mechanical contractor shall submit a minimum of one week before the request for building certificate of occupancy operating and maintenance manuals. The manuals shall include at a minimum the following.
 - 1. Equipment capacity (input and output) and required maintenance actions.

2. Equipment operation and maintenance manuals.
 3. HVAC system control maintenance and maintenance and calibration information, including wiring diagrams, schematics, control sequence descriptions. Desired or field determined set points shall be permanently recorded on control drawings, at control devices or, for digital control systems, in programming comments.
 4. Complete written narrative .of how each system is intended to operate.
- B. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition, any sub-system that the contractor is requesting for inclusion as substantial shall provide the O & M manuals for those sub-systems prior to issuance of the substantial completion for those sub-systems.
- C. In addition to the requirements specified in Division 1, include the following information for equipment items:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown and emergency instructions; and summer and winter operating instructions.
 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 4. Servicing instructions and lubrication charts and schedules.

2. PRODUCTS

2.1 MATERIALS

- A. Unless otherwise specified, all materials and equipment shall be new, unused, and undamaged. Materials and equipment shall be the current designs and models of manufacturers regularly engaged in their production.

2.2 MATERIALS AND EQUIPMENT FURNISHED BY OTHERS

- A. Where materials and equipment are indicated as furnished by others and installed or connected under this contract, it shall be the Contractor's responsibility to verify installation details and requirements and make all necessary accommodations.

2.3 QUANTITY OF SPECIFIED ITEMS REQUIRED

- A. Wherever in the Contract Documents an item, device, or piece of equipment is referred to in the singular number, such reference shall apply to as many such articles as are shown on the drawings or rquired to complete the installation.

3. EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety.

3.2 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. Store and handle material and equipment in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- C. Use proper lifting equipment where size/weight requires handling by such means.
- D. Comply with manufacturer's rigging and moving instructions for unloading material and equipment, and moving them to final location.
- E. Equipment requiring disassembly for access purposes shall be disassembled and reassembled as required for movement into the final location following manufacturer's written instructions.
- F. Deliver material and equipment as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.
- G. Mechanical Contractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.
- H. All piping is to be protected while stored for installation. Pipe ends are to be provided with pipe plugs, plastic wrap taped ends or pipe ends crimped closed. No exceptions. Piping found open will be tagged and prior to being installed by the contractor shall be cleaned, inspected by the owner representative and cleaning approved by the owner. Any pipe that has been installed without being approved by the owner shall be removed for visual inspection by the owner representative.
- I. Any material that is damaged during delivery, storage, handling, or installation shall be brought to the attention of the Architect/Engineer for review of its acceptability in the project.
 - 1. The Architect/Engineer shall be the sole and final judge as to the suitability of damaged items.

3.3 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

- B. Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.

3.4 COORDINATION

- A. All mechanical rooms shall be constructed to maintain a minimum 3'-6" wide x 7'-6" high clearance between mechanical equipment and accessories. All trades shall coordinate work to provide this space.
- B. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
- C. Coordinate the mechanical work with work of the different trades so that:
 - 1. Interferences between mechanical, electrical, architectural, and structural work, including existing services, will be avoided.
 - 2. Within the limits indicated on the drawings, the maximum practicable space for operation, maintenance repair, removal and testing of mechanical and other equipment will be provided.
 - 3. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including steam and condensate.
 - c. Equipment requiring access, including terminal units, fire/smoke dampers, and piping valves.
 - d. Ductwork.
 - e. Electrical busduct.
 - f. Electrical cable trays, including access space.
 - g. Piping (hydronic and plumbing).
 - h. Sprinkler/standpipe piping.
 - i. Electrical conduits and wireway.
 - 4. Pipes, ducts, and similar items, shall be kept as close as possible to ceiling, walls, and columns, to take up a minimum amount of space. Pipes, ducts, and similar items shall be located so that they will not interfere with the intended use of other equipment.
- D. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.
- E. Furnish and install, without additional expense to the Owner, all offsets, fittings and similar items necessary in order to accomplish the requirements of coordination.

3.5 MECHANICAL INSTALLATIONS

- A. Verify all dimensions by field measurements.
- B. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.

- C. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
- D. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- E. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect/Engineer.
- F. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- G. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- H. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- I. Coordinate and the required electrical services and associated voltage, amps, phase etc. for all equipment and the associated factory and field installed control and power devices as required for complete and operable systems.

3.6 ACCESSIBILITY

- A. All work shall be installed so as to be accessible for operation, maintenance and repair with particular attention given to locating valves, controls and equipment requiring periodic lubrication, cleaning, adjusting or servicing of any kind.

3.7 LUBRICATION AND TOOLS

- A. Provide a fresh charge of lubricant in accordance with manufacturer's recommendations to all equipment requiring lubrication prior to start-up and maintain lubrication as required until acceptance by Owner.
 - 1. List lubricant type/weight of lubricant during last service prior to start/up on each unit so that owner can use same lubricant type as previously used by contractor.
- B. Provide for each piece of equipment any special tools and a list of such tools required for the operation or adjustment of the equipment and turn over to the Owner's representative prior to final acceptance of the equipment.

3.8 GENERAL CONTRACTOR – MECHANICAL EXTENT OF WORK

- A. Access Panels

1. Furnish and install panels for access to valves and dampers and similar items where no other means of access, such as readily removable, sectional ceiling is shown or specified.
2. The plans indicate the location of all anticipated access panels. The Division 23 Contractor shall make every effort to locate all material and equipment requiring service and maintenance above accessible ceilings or utilize the indicated access panels. Material and equipment requiring service and maintenance that is shown above inaccessible ceilings shall be relocated to accessible or exposed areas whenever possible. When these items are located in exposed areas, the Division 23 Contractor is to verify with the Architect/Engineer that the installation will not affect the aesthetics of the building. However, when it is not possible to locate these items in accessible or exposed areas due to the configuration of the actual installation of the mechanical and other trade systems or aesthetic reasons, additional access panels shall be provided. The contractor shall be equitably compensated for the additional access panels.

B. Cutting and Patching

1. General: Perform cutting and patching in accordance with Division 1. In addition to the requirements specified in Division 1, the following requirements apply:
2. The Division 23 Contractor shall coordinate all cutting and patching of holes, in existing building and new construction which are required for the passage of mechanical work.
3. Division 23 Contractor is to notify the General Contractor prior to submitting his bid, the number, size and location of all cutting and patching requirements. The Division 23 Contractor shall be liable for all associated costs of cutting and patching for mechanical work upon failure to notify the General Contractor prior to bid submission.
4. Under no circumstances shall any structural members, load-bearing walls or footings be cut without first obtaining written permission from the Engineer.
5. Cut, channel, chase and core drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
6. Patching of concrete openings shall be filled with grout and finished smooth with the adjacent surface.
7. All below-grade openings for pipe shall be sealed with interlocking synthetic rubber line assembly, Link-Seal by Thunderline Corporation or equal.
8. Repair cut surfaces to match adjacent surfaces.
9. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - a. Uncover work to provide for installation of ill-timed work.
 - b. Remove and replace defective work.
 - c. Remove and replace work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Excavation and Backfilling

1. Division 23 Contractor shall perform all excavation and backfilling necessary to install the required mechanical work. Coordinate the work with other excavating and backfilling work in the same area.
2. Except as indicated otherwise, comply with the applicable sections in Division 2 of these specifications, excavation filling and backfilling (for structures) to 5' outside the building line, and exterior utilities sections for beyond 5' from the building line.

3. Trenching: Trench width shall be no more than required for shoring, bracing and performance of the work. All necessary shoring and bracing shall be installed to insure worker safety, proper installation of mechanical work, and protection of adjacent structures. Provide all dewatering as required. Depth shall not exceed that required to achieve the specified depth of cover and overdig will be permitted for bedding material only. All trenches shall be open cut from the surface.
4. Bedding: All work shall be properly bedded whether on virgin soil or on granular bedding as specified. All granular bedding shall be laid on undisturbed soil. PVC and copper piping shall have a 4" crushed stone bed conforming to specification for granular material in Division 2. If rock is encountered, excavate to a point 4" below installed bottom elevation of piping and provide bedding as called for above.
5. Haunching: Haunching shall be brought up on both sides of the pipe for a distance of 1/3 the pipe diameter and shall be of the same material used for bedding.
6. Backfill: Backfilling shall not begin until installation has been tested for leaks.
7. Final Backfill shall be as follows:
 - a. Outside Building Under Paved Areas: Granular material specified in Division 2.
 - b. Outside Building and Not Under Paved Areas: Clean soil free of vegetable matter and foreign material or crushed limestone. In planted areas backfill to a point 6" below finished grade. Owner will provide topsoil to finished grade.
8. Placement: Place all granular material in lifts of 12" maximum compacted to 100% of maximum dry density as determined as ASTM D698. Place soil in 6" lifts compacted to 95% of maximum density as determined by ASTM D698. Do not place any backfill until excavations have been cleaned of all water, debris and loose or soft soil.
9. Protection: At least 72 hours prior to excavating, for each phase, Contractor shall contact the Owner's Representative to arrange for utility locates in the construction area.
10. Contractor shall provide temporary supports for all underground utilities crossing an excavation.
11. Provide all required barricades, fencing, signs, lights, etc. as necessary for the protection of the workers and of the general public.
12. Excess Material: All excess earth and other material resulting from the excavation shall be removed from site daily by the Contractor.
13. Landscape work, pavement, flooring and similar exposed finish work that is disturbed or damaged by excavation shall be repaired and restored to their original condition by the Mechanical Contractor.

D. Concrete Bases:

1. Minimum 4" high concrete housekeeping pads shall be provided under all floor-mounted mechanical equipment, regardless of whether explicitly shown on the Drawings. Concrete inertia pads with spring isolators shall be provided for all base-mounted pumps and air compressors installed on any floors which are not slab-on-grade. Inertia pads and isolators shall be sized by the equipment manufacturer if specific information is not provided in the Contract Documents.
2. Contractor shall verify, prior to submitting his bid, the number, size and location of all mechanical equipment bases.
3. Construct concrete equipment bases a minimum 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000 psi, 28-day compressive strength concrete, reinforcement and forms as specified in Division 3 Section "Cast-In-Place Concrete." Coordinate final equipment base size with General Contractor.
4. All equipment shall be mechanically fastened to concrete bases.

E. Painting

1. Field paint mechanical equipment and materials in specified areas as noted on the mechanical plans, mechanical schedules and in the specifications. Where items are to be painted, provide materials in these areas that are suitable for accepting paint. Clean and prepare the materials as necessary prior to painting, including removal of sharp edges. At minimum, items in these areas shall be painted:
 - a. Exposed items in areas other than mechanical rooms. Paint color shall match the adjacent surfaces (i.e. walls, ceilings, etc.) and shall follow the patterns of any adjacent accent colors.
 - 1) Items insulated with aluminum or stainless steel jackets are not required to be painted.
 - b. Concealed field-fabricated bare iron or steel items required for installation of work under this Division. Remove rough or sharp edges prior to painting.
 - c. Exposed field-fabricated bare iron or steel items required for installation of work under this Division. Remove rough or sharp edges prior to painting.
 - d. Exterior items which are not factory-painted. Paint color shall be selected by Architect.
2. Paint all items in accordance with Division 09 sections.

3.9 ELECTRICAL-MECHANICAL EXTENT OF WORK

- A. The responsibility of work specified under Division 23 and 26 is clarified under, Section 23 05 13, "Electrical Requirements for Mechanical Equipment. Division 23 Contractor is to coordinate all electrical requirements prior to ordering powered mechanical equipment.

END OF SECTION 23 05 00

SECTION 23 05 13 - ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

1. GENERAL

1.1 SECTION INCLUDES

- A. Electrical Requirements for:
 - 1. Motors
 - 2. Starters, Electrical Devices, and Wiring

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
 - 1. Electrical components and materials shall be UL labeled and listed.
- B. References.
 - 1. The design, manufacture, testing and method of installation of all equipment and materials furnished under the requirements of this specification section shall conform to the following:
 - a. AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
 - b. AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.
 - c. ANSI/IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators.
 - d. ANSI/NEMA Standard MG 1 – Motors and Generators.
 - e. ANSI/NFPA 70 - National Electrical Code.
 - f. NEMA Standard ICS 2 – Industrial Control Devices, Controllers, and Assemblies.
 - g. NEMA Standard 250 – Enclosures for Electrical Equipment.
 - h. NEMA Standard KS 1 – Enclosed Switches.
- C. Submittals.
 - 1. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, or as required by the individual equipment specification sections.
- D. Operation and maintenance manuals.
- E. Project record documents.
- F. Delivery, storage, and holding
- G. Related sections.

1. Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.

1.3 SUMMARY

- A. This section specifies the basic requirements for electrical components which are an integral part of packaged mechanical equipment. These components include, but are not limited to factory installed motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment. In addition, this section covers necessary coordination issues between mechanical and electrical disciplines. All mechanical and electrical construction documents must be completely reviewed by the Mechanical and Electrical Contractors prior to the submission of bids. Any discrepancies in the documents should be brought to the Architect/Engineer's attention at that time. Failure to properly coordinate or review documents in advance of submission of bids will not be valid cause for changes to the overall Contract amount.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.

2. PRODUCTS

2.1 MOTORS

- A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
 1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
 2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. Minimum service factors shall be as follows:

Motor Service Factor Schedule		
Horsepower:	3600 RPM:	1800 RPM:
1/6 – 1/3	1.35	1.35
1/2	1.25	1.25
3/4	1.25	1.25
1 – 1.25	1.25	1.15
1.5 - 150	1.15	1.15

3. Two-speed poly-phase motors shall have two separate windings served by a single point electrical connection to the two speed starter. Two speed starters shall be located at the motor location unless otherwise noted.
4. Temperature Rating: Rated for 40 deg. C environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).
5. Starting capability: Frequency of starts as indicated by automatic control system, and not less than five (5) evenly timed starts per hour for manually controlled motors.
6. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.

- a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's

- standards to suit each specific application.
- b. Bearings: Ball or roller bearings with inner and outer shaft seals; re-greasable; designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor; for fractional horsepower, light duty motors, sleeve type bearings are permitted.
 - c. Enclosure Type: Unless otherwise noted, use open drip-proof motors where satisfactorily housed or remotely located during operation; guarded drip-proof motors where exposed to contact by employees or building occupants; weather protected Type I for outdoor use, Type II where not housed.
 - d. Overload protection: Built-in thermal overload protection (in accordance with NEC requirements) and, where indicated, an internal sensing device suitable for signaling and stopping the motor at the starter.
- 7. Noise rating: "Quiet"
 - 8. Efficiency: **"Premium efficiency"** motors, as defined in NEMA MG 1, most recent edition.
 - 9. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
 - 10. All three-phase motors shall be inverter duty type.
 - 11. Motors Used With Variable Frequency Drives: Ratings, characteristics, and features coordinated with and approved by drive manufacturer. Motor shall be designed and labeled for use with variable frequency drives. Motor shall be designed with critical vibration frequencies outside the operating range of the drive output and shall be suitable for use throughout speed range without overheating.
- a. Provide AEGIS SGR, or approved equivalent, shaft grounding ring/system to divert adverse shaft currents away from the motor bearings. Use AEGIS Colloidal Silver Shaft Coating (PN CS015), or approved equivalent, prior to ring installation. Install coating and ring per manufacturer recommendations.
- 12. Motors Used for Wet or Corrosive Duty: Severe duty with cast-iron frame, epoxy finish, stainless steel nameplate, polymer shaft seal, corrosion-resistant fasteners and fan, moisture-resistant windings, and non-wicking leads.

2.2 STARTERS, ELECTRICAL DEVICES, AND WIRING

- A. Motor-Starter Characteristics: Motor starters shall be compatible with the equipment they serve. In general, motor starter characteristics shall meet the requirements of Division 26 specification sections and as outlined as follows:
- B. Unless specifically approved in writing by the engineer, or as stated later in this paragraph, motor starters, VFDs and motor controllers (including equipment with integral motor starting) for motors shall have short circuit current ratings equivalent to the switchboard or electrical panel serving the load immediately upstream of the load. Refer to the electrical drawings for switchboard and electrical panel ratings. Provide additional overcurrent device protection if necessary to meet this requirement.

1. Exception: Where a motor or combination of motors is less than 10 horsepower in total and fed by more than 50 feet of wiring between the switchboard or panel that it is served by and the motor starter/controller/VFD, the starter/controller/VFD may have a short circuit current rating of 5000 Amps.

C. Motor Connections

1. Provide connections to motors in accordance with the requirements listed in the electrical specifications.
2. See Division 26 for the use of lugs for motor connections.

3. EXECUTION

3.1 INSTALLATION

- A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.
- C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations. Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

3.2 CONTRACTOR COORDINATION

- A. General contractor is responsible for coordination of all subcontractors and associated scopes of work.

END OF SECTION 23 05 13

SECTION 23 05 29 – HVAC HANGERS AND SUPPORTS

1. GENERAL

1.1 SECTION INCLUDES

- A. Ductwork, and equipment hangers, supports, anchors, saddles and shields.
- B. Mechanical flashing.
- C. Mechanical sleeves and seals.
- D. Flashing and sealing equipment.
- E. Sealants, firestop insulation, putty and compounds.

1.2 Equipment Pad Supports.

1.3 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
- B. References.
- C. Submittals.
 - 1. Product Data and Details: For each type of product.
 - 2. Hanger, Support, and Attachment Schedule: Include hanger, support, and attachment schedule that includes pipe system, pipe sizes, hanger, support, and attachment type.
 - 3. Detail application of protective shields, saddles, and inserts at hangers for each type of pipe/insulation and hanger.
- D. Operation and maintenance manuals.
- E. Project record documents.
- F. Delivery, storage, and handling.

2. PRODUCTS

2.1 DUCTWORK HANGERS AND SUPPORTS

- A. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- B. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

- C. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Exposed Stainless-Steel Ducts: Stainless-steel shapes and plates.

2.2 ACCESSORIES

- A. Hanger Rods: ASTM A36 steel or galvanized threaded both ends, threaded one end, or continuous threaded.
 - 1. Ductwork: Use double nuts and lock washers on threaded rod supports.

2.3 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Internally Threaded Screw Anchors: Internally threaded, self tapping screw anchors, Power Fasteners Snake or approved equivalent.
 - 1. Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI318 (Strength Design method using Appendix D)

2.4 FLASHING

- A. Metal Flashing: 26 gage galvanized steel.
- B. Metal Counterflashing: 22 gage galvanized steel.
- C. Lead Flashing:
 - 1. Waterproofing: 5 lb/sq ft sheet lead
 - 2. Soundproofing: 1 lb/sq ft sheet lead.
- D. Flexible Flashing: 47 mil thick sheet buty; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

- A. Sleeves for Round Ductwork: Galvanized steel.

- B. Sleeves for Rectangular Ductwork: Galvanized steel.

2.6 SEALANTS, FIRESTOP INSULATION, PUTTY, AND COMPOUNDS

- A. Firestopping Insulation: Glass fiber type, non-combustible, UL listed.
- B. Firestop Putty: Non-hardening, non shrinking, UL listed.
- C. Firestop Compounds: Cementitious material, non-shrinking, UL listed.
- D. Sealants:
 - 1. Non fire/smoke rated partitions: Acrylic or silicone based caulking.
 - 2. Fire/smoke rated partitions: Silicone based caulking, UL listed.

3. EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 FLASHING

- A. Provide flexible flashing and metal counterflashing where ductwork penetrate weather or waterproofed walls and floors.
- B. Provide acoustical lead flashing around ducts penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

3.4 SLEEVES

- A. Provide duct sleeves at all fire/smoke rated partitions, exterior wall penetrations and wall penetrations into exposed areas. Pipe and duct sleeves are not required for penetrations through non-rated concealed partitions.
 - B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
 - C. Where ductwork penetrates non-rated ceilings or walls, close off space between pipe or duct and adjacent work with urethane rod stock and caulk air tight.
 - D. Seal duct penetrations through non-rated floors.
 - 1. Where piping is not located in a rated shaft and it penetrates a single non-rated floor, close off space between pipe and adjacent work with urethane rod stock and caulk air tight.
 - 2. Where piping is not located in a rated shaft and it penetrates multiple non-rated floors, close off space between pipe and adjacent work with appropriate fire-rated sealant, insulation, putty, or compound.
 - 3. Where ductwork is not located in a rated shaft and it penetrates a single non-rated floor, close off space between duct and adjacent work with appropriate fire-rated sealant, insulation, putty, or compound.
 - 4. Where ductwork is not located in a rated shaft and it penetrates multiple non-rated floors, close off space between duct and adjacent work with appropriate fire-rated sealant, insulation, putty, or compound. Install fire damper in duct at each floor level. Ductwork containing fume exhaust air shall not be provided with fire dampers.
 - E. Where ductwork penetrates rated floor, ceiling, or wall, close off space between pipe or duct with appropriate fire rated sealant, insulation, putty or compound. Refer to the Drawings for fire/smoke rated wall locations and the appropriate ratings.
 - F. Provide on ductwork close fitting metal collar or escutcheon covers on the side of penetration that are exposed to view.
 - G. Provide mechanical seals and sleeves through exterior wall and floor penetrations and 3 hour or higher fire rated partitions.
- ### 3.5 EQUIPMENT PAD SUPPORTS
- A. Provide a minimum of two equipment pad supports for each pad-mounted equipment item that does not have integral equipment rails that would extend the bottom of the equipment. Coordinate location of pad supports with equipment manufacturer.

- B. Provide all necessary sealants and flashing required for a waterproof installation. Coordinate with roof manufacturer and other trades.

END OF SECTION 23 05 29

SECTION 23 05 53 - HVAC IDENTIFICATION

1. GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Duct Markers.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
- B. References.
- C. Submittals.
 - 1. Product Data: For each type of product indicated.
 - 2. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
 - 3. Valve-numbering scheme.
 - 4. Valve Schedules: For each piping system. Include in operation and maintenance manuals.
- D. Operation and maintenance manuals.
- E. Project record documents
 - 1. Record actual locations of tagged valves.
- F. Delivery, storage, and handling.

2. PRODUCTS

2.1 NAMEPLATES

- A. Equipment Mark Nameplates: Laminated three-layer plastic with engraved black letters (matching equipment mark indicated on drawings) on light contrasting background color, with minimum 3/4 inch high letters.
- B. Equipment Nameplates: Factory-applied permanent nameplate indicating the manufacturer's name, model, serial number, temperature and pressure design, and any other data necessary to conform with specified requirements. On equipment installed outdoors, nameplate shall be stamped steel or engrave plastic.

2.2 DUCT MARKERS

- A. Plastic Tape Duct Markers: Minimum 1-1/2" letter size and 2-mil thickness, flexible, vinyl film tape with pressure sensitive adhesive backing and printed marking; minimum information indicating flow direction arrow and identification of air system being conveyed.

3. EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install plastic tape pipe and duct markers in accordance with manufacturer's instructions. Directional arrow tape shall be overlapped to ensure proper adhesion and no peeling of tape in future.
- C. Identify air handling units, exhaust fans, chillers, pumps, heat generating, heat rejecting, heat transfer equipment, tanks, and water treatment devices with plastic nameplates.
- D. Identify ductwork with plastic tape duct markers. Identify service, flow direction and pressure when applicable, i.e. low pressure supply air, high pressure supply air. Install in clear view from floor and align with centerline of duct. Locations of identification not to exceed 15 feet from straight runs including risers and drops, more often in congested areas, at each side of penetration of structure or wall, and at each obstruction. When several ducts from different units are located in concealed congested areas, locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

1. GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing (TAB) of air systems.
- B. Measurement of final operating condition of mechanical systems.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. References.
- B. Submittals.

C. PROJECT RECORD DOCUMENTS

- 1. Record actual locations of all sensors, flow measuring stations, balancing valves and rough setting.
- D. Quality assurance.
 - 1. Perform total system balance in accordance with one of the following:
 - a. AABC National Standards for Field Measurement and Instrumentation, Total System Balance.
 - b. NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
 - c. TABB Quality Assurance Program for Environmental System Balance
 - 2. Instrumentation type, quantity, accuracy, and calibration shall be as described in ASHRAE 111, Section 5, "Instrumentation."
 - 3. Comply with applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
 - 4. Comply with applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.3 Qualifications.

- 1. Perform Work under supervision of AABC, NEBB, or TABB certified contractor.

1.4 On site pre-balancing conference.

- 1. Convene prior to commencing work of this section. At a minimum, the attendees shall include the Architect/Engineer and representatives of the installers of all HVAC systems, including temperature controls. The objective of this meeting is final coordination and verification of system operation and readiness for work of this section.
- 2. No balance reports shall be accepted nor final payment made unless such conference occurs and is fully documented as to those attending and subjects covered.

1.5 Project Conditions

1. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.
2. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.6 Scheduling/Coordination.

1. Notice: Provide seven days advance notice for each test. Include scheduled test dates and times.
2. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 EXAMINATION

- A. Before commencing work and prior to convening the pre-balancing conference, the TAB agency shall coordinate with the appropriate mechanical contractors that the following conditions have been met:
1. Systems are started and operating in a safe and normal condition.
 2. Temperature control systems are installed complete and operable.
 3. Proper thermal overload protection is in place for electrical equipment.
 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 5. Duct systems are clean of debris.
 6. Fans are rotating correctly.
 7. Fire and volume dampers are in place and open.
 8. Air coil fins are cleaned and combed.
 9. Access doors are closed and duct end caps are in place.
 10. Air outlets are installed and connected.
 11. Hydronic systems are flushed, filled, and vented.
 12. Pumps are rotating correctly.
 13. Proper strainer baskets are clean and in place.
 14. Service and balance valves are open.
- B. Submit field reports at the pre-balancing conference. Report ALL defects and deficiencies noted during performance of services which prevent system balance.
- C. Beginning of work means acceptance of existing conditions.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided. Windows and doors can be closed so indicated conditions for system operations can be met.

C. Windows and doors can be closed so indicated conditions for system operations can be met.

D. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

E. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within +5 to 10 percent of design for supply systems, return and exhaust systems.

B. Air Outlets in Negatively Pressurized Spaces: Adjust total to within 0 to -5 percent of design to space.

C. Air Inlets in Negatively Pressurized Spaces: Adjust total to within 0 to +5 percent of design from space.

D. Air Outlets in Positively Pressurized Spaces: Adjust total to within 0 to +5 percent of design to space.

E. Air Inlets in Positively Pressurized Spaces: Adjust total to within 0 to -5 percent of design from space.

F. Air Outlets in Non-Pressurized Spaces: Adjust total to within 0 to +10 percent of design to space.

G. Air Inlets in Non-Pressurized Spaces: Adjust total to within 0 to -10 percent of design from space.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 - Ductwork Insulation.

- B. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings
- C. Ensure recorded data represents actual measured or observed conditions.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 23 31 13 – Ductwork.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.

- a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - c. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. First two subparagraphs below may require changes to installed systems or equipment; these changes may require a contract modification.
6. Obtain approval from Commissioning Authority or adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.8 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB contractor.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.

7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
 12. Indicated versus final performance.
 13. Notable characteristics of systems.
 14. Description of system operation sequence if it varies from the Contract Documents.
 15. Nomenclature sheets for each item of equipment.
 16. Data for terminal units, including manufacturer's name, type, size, and fittings.
 17. Notes to explain why certain final data in the body of reports vary from indicated values.
 18. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor, return, and exhaust air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches (mm), and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches (mm), and bore.
- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

- a. Total air flow rate in cfm (L/s).
- b. Total system static pressure in inches wg (Pa).
- c. Fan rpm.
- d. Discharge static pressure in inches wg (Pa).
- e. Filter static-pressure differential in inches wg (Pa).
- f. Preheat-coil static-pressure differential in inches wg (Pa).
- g. Cooling-coil static-pressure differential in inches wg (Pa).
- h. Heating-coil static-pressure differential in inches wg (Pa).
- i. Outdoor airflow in cfm (L/s).
- j. Return airflow in cfm (L/s).
- k. Outdoor-air damper position.
- l. Return-air damper position.
- m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch (mm) o.c.
- f. Make and model number.
- g. Face area in sq. ft. (sq. m).
- h. Tube size in NPS (DN).
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm (L/s).
- b. Average face velocity in fpm (m/s).
- c. Air pressure drop in inches wg (Pa).
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
- e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
- f. Entering air, wet, and drybulb temperatures in deg F (deg C).
- g. Leaving air, wet, and drybulb temperatures in deg F (deg C).
- h. Water flow rate in gpm (L/s).
- i. Water pressure differential in feet of head or psig (kPa).
- j. Entering-water temperature in deg F (deg C).
- k. Leaving-water temperature in deg F (deg C).
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig (kPa).
- n. Refrigerant suction temperature in deg F (deg C).

- o. Inlet steam pressure in psig (kPa).
- G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
 - 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btu/h (kW).
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches (mm), and bore.
 - n. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 - 2. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm (L/s).
 - b. Entering-air temperature in deg F (deg C).
 - c. Leaving-air temperature in deg F (deg C).
 - d. Air temperature differential in deg F (deg C).
 - e. Entering-air static pressure in inches wg (Pa).
 - f. Leaving-air static pressure in inches wg (Pa).
 - g. Air static-pressure differential in inches wg (Pa).
 - h. Low-fire fuel input in Btu/h (kW).
 - i. High-fire fuel input in Btu/h (kW).
 - j. Manifold pressure in psig (kPa).
 - k. High-temperature-limit setting in deg F (deg C).
 - l. Operating set point in Btu/h (kW).
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btu/h (kW).
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches (mm), and bore.

- h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
- 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches (mm), and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 - g. Number, make, and size of belts.
- 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg (Pa).
 - e. Suction static pressure in inches wg (Pa).
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F (deg C).
 - d. Duct static pressure in inches wg (Pa).
 - e. Duct size in inches (mm).
 - f. Duct area in sq. ft. (sq. m).
 - g. Indicated air flow rate in cfm (L/s).
 - h. Indicated velocity in fpm (m/s).
 - i. Actual air flow rate in cfm (L/s).
 - j. Actual average velocity in fpm (m/s).
 - k. Barometric pressure in psig (Pa).
- J. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.9 ADDITIONAL TESTS

- B. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- C. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 13 - DUCTWORK INSULATION

1. GENERAL

1.1 SECTION INCLUDES

- A. Ductwork insulation.
- B. Insulation jackets.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. References.
- B. Submittals.
 - 1. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
 - 2. Insulation Schedule: Include ductwork insulation schedule that includes system and duct type (round/rectangular), insulation type, insulation thickness, and jacket type (where applicable).
- C. Delivery, Storage, and Handling.
- D. Quality assurance.
 - 1. Materials: ASTM E84 Flame spread/smoke developed rating of 25/50 or less.
- E. Qualifications.
 - 1. Applicator: Company specializing in performing the work of this section with minimum three years experience.
- F. Environmental requirements.
 - 1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
 - 2. Maintain temperature during and after installation as recommended by the manufacturer.

2. PRODUCTS

2.1 GLASS FIBER, FLEXIBLE

- A. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. 'K' value: ASTM C518, 0.30 at 75 degrees F.
 - 2. Maximum service temperature: 250 degrees F.
 - 3. ASTM C1104 Water Vapor Sorption less than 5% by weight
 - 4. Density: 1.5 lb/cu ft.

B. Vapor Barrier Jacket

1. Vapor Retarder Jacket: FSK or PSK confirming to ASTM C 1136 Type I, II.
2. Moisture vapor transmission: ASTM E96; 0.02 perm maximum.
3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Tie Wire: Annealed steel, 16 gage (1.5 mm).

2.1 EXTERIOR DUCT INSULATION

A. Polyisocyanurate Foam Sheathing: ASTM C1289; Foil-faced uniform closed-cell board. Johns Manville AP Foil-Faced or equivalent.

1. 'R' Value: 9.0 at 1-1/2" board thickness.
2. Minimum Service Temperature: -100 degrees F.
3. Maximum Service Temperature: 250 degrees F.
4. Moisture Vapor Transmission: ASTM E96; 0.03 perm-inches.
5. Connection: Waterproof vapor barrier adhesive.
6. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - a. Adhesive: As recommended by jacket material manufacturer.
 - b. Color: White
 - c. PVC Jacket only required for ductwork on exterior of building.

3. EXECUTION

3.1 EXAMINATION

- A. Verify that ductwork has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- C. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
- D. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

- E. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
- F. Secure insulation without vapor barrier with staples (staples only work well when there is a facing present), tape, or wires.
- G. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
- H. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
- I. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- J. Do not overtighten and/or compress flexible glass fiber duct insulation.
- K. At duct access doors or other openings, insulation shall be properly framed and finished.
- L. Exterior Insulation Application:
 - 1. Polyisocyanurate:
 - a. Install in accordance with manufacturer's recommendation.
 - b. Use product compliant adhesive for board installation
 - c. Taper insulation on top of ductwork to allow positive drainage.
 - d. Field-apply jacketing using pressure-sensitive adhesive and hand roller.
 - e. Install jacketing continuous across bottom of ductwork extending minimum 6" up each side of duct. Pin duct bottoms over 36" in width.

3.3 GLASS FIBER DUCTWORK INSULATION SCHEDULE

Ductwork Application:	Type:	Thickness:	Vapor Barrier Required (Y/N):
Exterior Ductwork	Exterior	2"	Y
Exposed and concealed rectangular and round supply air duct	Flexible	2"	Y
Return air duct	None required unless shown on plans		
Exhaust air duct	None required unless shown on plans		
Exterior Ductwork (supply and return)	Exterior	2"	Y

Schedule Notes:

- A. All ductwork in mechanical rooms shall be insulated as though it were "Exposed".
- B. Any exterior ductwork requiring insulation from the categories above shall be insulated as "Exterior."

END OF SECTION 23 07 13

SECTION 23 09 93 - SEQUENCE OF OPERATION

1. GENERAL

- 1.1 The sequences provided in this section are subject to minor modifications during shop drawing review phase and system start-up. These minor changes are usually due to the specific operating characteristics of the HVAC equipment actually installed and/or building dynamics. These minor sequence modifications shall be incorporated without additional charges to the Owner.
- 1.2 All control set points called out shall be adjustable through software.

2. PACKAGED ROOFTOP UNIT AND DEHUMIDIFICATION SYSTEMS

- A. The RTU shall operate as standalone via the factory-provided and programmed unit controller and a programmable thermostat. The controller shall control the unit based on the following default modes of operation and setpoints: Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. RTU to receive low voltage input from EF-1 to modulate damper position. RTU to have 100 CFM of OA during normal operations, when EF-1 is engaged provide full 450 CFM of OA.
- 2.2 Occupied:
 - A. During occupied periods, the supply fan shall run continuously and the outside air damper shall open to maintain minimum ventilation requirements. Upon a call for DX cooling, the unit controller shall enable the fixed speed compressor. The compressor shall be cycled on and off to maintain the active space temperature setpoint. The gas heat shall be enabled and controlled to maintain the active space temperature setpoint. If the discharge air temperature sensor fails, the DX cooling and the gas heat shall control to maintain the active space temperature setpoint and an alarm shall annunciate at the unit controller. If the space temperature sensor fails, the mechanical cooling shall be disabled, the mechanical heating shall be disabled, and an alarm shall annunciate at the unit controller.
 - 2.3 Unoccupied:
 - A. During the unoccupied periods, the supply fan shall be disabled, the outside air damper shall close, the mechanical cooling shall be disabled, the mechanical heating shall be disabled, to conserve energy.
 - B. When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall be commanded on, the outside air damper shall open if economizing is enabled and remain closed if economizing is disabled, and the mechanical cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F (adj.) minus the unoccupied differential of 4.0 deg. F (adj.) the supply fan the outside air damper shall close, and the mechanical cooling shall be disabled.
 - C. When the space temperature is below the unoccupied heating setpoint of 60.0 deg. F (adj.) the supply fan shall be commanded on, and the mechanical heating shall be enabled. When the space temperature rises above the unoccupied heating setpoint of 60.0 deg. F (adj.) plus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall be commanded off, the mechanical heating shall be disabled.

2.4 Optimal Start:

- A. The unit controller shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

2.5 Optimal Stop:

- A. The unit controller shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint. Outside air damper shall remain enabled to provide minimum ventilation.

2.6 Morning Warm-Up Mode:

- A. During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and fan(s). The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

2.7 Pre-Cool Mode:

- A. During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling or economizer. The outside air damper shall remain closed, unless economizing. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

2.8 Occupied Bypass:

- A. The unit controller shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

2.9 Heat/Cool Mode:

- A. When the space temperature rises above the occupied cooling setpoint the mode shall transition to cooling. When the space temperature falls below the occupied heating setpoint the mode shall transition to heating. When the space temperature is above the occupied cooling setpoint or below the occupied heating setpoint the mode shall remain in its last state. If the space temperature sensor fails the mode shall remain in its last state and an alarm shall annunciate at the unit controller. If the local and communicated setpoints fail the controller shall disable the supply fan and an alarm shall annunciate at the unit controller.

2.10 Dehumidification:

- A. SINGLE CIRCUIT UNITS: During dehumidification mode, cooling capacity shall be dictated by the reheat capacity control.
- B. SINGLE COMPRESSOR UNITS: On a call for dehumidification, the hot gas reheat valve shall energize, and the compressor shall enable. When the humidity control setpoint is satisfied, the valve shall be de-energized, and the compressor shall be disabled. If there is a call for cooling

from the space temperature controller, while in reheat, the reheat valve shall be de-energized, and the compressor continues to run.

2.11 Supply Fan:

- A. The supply fan shall be enabled while in the occupied mode and cycled on during the unoccupied mode. The unit controller shall vary the supply fan speed to optimize minimum fan speed in all cooling and heating modes. A differential pressure switch shall monitor the differential pressure across the fan. If the switch does not open within 40 seconds after a request for fan operation a fan failure alarm shall annunciate at the unit controller, the unit shall stop, requiring a manual reset.

2.12 Filter Timer:

- A. The fan-run time (hrs) shall be compared to the filter maintenance timer setpoint. Once the setpoint is reached a filter timer alarm diagnostic shall annunciate at the unit controller. When the diagnostic is cleared, the filter-maintenance timer is reset to zero, and the timer begins accumulating fan-run time again.

2.13 Refrigerant Mitigation Mode:

- A. The unit controller shall monitor the leak detection system every 5 seconds, when a leak is detected, mitigation shall be activated.
- B. In occupied mode, the supply fan shall remain operational, and the compressor(s), electric heating, fuel-fired heating, electrostatic devices, and any other ignition device starters shall be disabled, and activate mechanical ventilation (if it's required by Section 7.6.4 of the ASHRAE standard). for the duration of the mitigation process plus an additional 5 minutes.
- C. In unoccupied mode, the supply fan shall remain operational, and the compressor(s), electric heating, fuel-fired heating, electrostatic devices, and any other ignition device starters shall be disabled, and activate mechanical ventilation (if it's required by Section 7.6.4 of the ASHRAE standard). for the duration of the mitigation process plus an additional 5 minutes.

END OF SECTION 23 09 93

SECTION 23 31 13 - DUCTWORK

1. GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

1. Sheet metal materials.
2. Sealant and gaskets.
3. Fasteners.
4. Duct cleaning.
5. Duct pressure testing.

B. Insulated flexible ductwork.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

A. Quality assurance.

1. Perform Work in accordance with the following standards:

- a. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- b. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
- c. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.
- d. SMACNA - HVAC Air Duct Leakage Test Manual.
- e. SMACNA – HVAC Duct Construction Standards - Metal and Flexible.
- f. SMACNA - Round Industrial Duct Construction Standards
- g. International Mechanical Code, current edition.

B. References.

C. Submittals.

1. Submit detailed CAD-generated ductwork detail drawings at minimum 1/4" scale, with details of the following:

- a. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
- b. Duct layout indicating pressure classification and sizes on plans.
- c. Seam and joint construction.
- d. Penetrations through fire-rated and other partitions.
- e. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

NOTE: No installation of ductwork shall be allowed until detailed shop drawings have been reviewed by the Engineer. Any ductwork that is installed prior to the Engineer's review of the shop drawings shall be subject to removal and replacement at the Contractor's expense.

2. Submit ductwork schedule listing duct system, duct material, joint construction, pressure class, sealant class, and leakage class.
- D. Performance requirements.
1. No variation of duct configuration or sizes shall be permitted except by written permission.
- E. Project record documents.
1. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.
 2. Provide copy of owner approval/acceptance of ductwork cleaning.
 3. Provide copy of completed duct leakage test reports.
- F. Qualifications.
1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
 2. Installer: Company specializing in performing the work of this section with minimum five years experience.
- G. Regulatory requirements.
1. Construct all ductwork per codes listed in section 1.2.E
- H. Environmental requirements.
1. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
 2. Maintain temperatures during and after installation of duct sealants.

2. PRODUCTS

2.1 METAL DUCTWORK

A. SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - a. Reference SMACNA figure 2-9 and Drawings to construct gradual transitions where ductwork changes size or offsets.
 - b. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
2. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- a. Transverse Duct Connection System
 - 1) Slide on flange system: Ductmate and Ductmate WDCI connection system complete with interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.
 - 2) Formed on flange system: TDC, TDF or equivalent connection system or equivalent. Such flanges shall be constructed as SMACNA T-24 flange (Page 1-25 and 1-37 '85 SMACNA Duct Construction Manual, 1985 Edition).
3. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
4. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Construct T's, and elbows in using radius of not less than 1-1/2 times width of duct on centerline. Where mitered rectangular elbows are used or indicated, provide turning vanes in accordance with Section 23 33 00.
5. Welded ductwork is to be weld with filler rod of the same material as the metal that is being welded. Coat welded joints with protective paint to prevent damage to galvanized surfaces.

B. SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - a. Round and oval duct shall be spiral lockseam duct with light reinforcing corrugations unless indicated otherwise.
2. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
3. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 - b. Joints shall be minimum 2 inch insertion length for joint connections.
 - c. Transverse Duct Connection System
 - 1) Slip type connector: Keating coupler.
 - 2) Slide on flange system. Spiralmate and Ovalmate connection system complete with interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

- 3) Formed on flange system: Factory-applied Van Stone connection on one end of the duct with field-applied Van Stone connector on the other end of the duct. Provide factory-applied Van Stone connections on each end of fittings.
4. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
5. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Construct T's, bends, and elbows with minimum bend radius elbows shall be 1.5 times the duct diameter (major or minor axis on oval ductwork depending on direction of bend). Where not possible and where mitered elbows are used or indicated, provide turning vanes in accordance with Section 23 33 00.
6. Welded ductwork is to be weld with filler rod of the same material as the metal that is being welded. Coat welded joints with protective paint to prevent damage to galvanized surfaces.
7. On round and oval ducts, provide 45 deg wye tee take-offs or 90 deg conical tee take-offs or 45 degree low loss entry tee take-offs or other fitting as indicated on plans. Straight taps are not acceptable.

C. SHEET METAL MATERIALS

1. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
2. Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90. Provide mill-phosphatized finish for surfaces of ducts exposed to view.
3. Stainless Steel Ducts: ASTM A 480/A 480M, Type 316 sheet form with No. 4 finish for surfaces of ducts exposed to view, and Type 304 sheet form with No. 1 finish for concealed ducts.
4. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061- T6 or of equivalent strength.
5. Factory- or Shop-Applied Antimicrobial Coating:
 - a. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
 - b. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

- c. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
 - d. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- 6. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 7. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

D. SEALANT AND GASKETS

- 1. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- 2. Two-Part Tape Sealing System:
 - a. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - b. Tape Width: Min. 3 inches.
 - c. Sealant: Modified styrene acrylic.
 - d. Water resistant.
 - e. Mold and mildew resistant.
 - f. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - g. Service: Indoor and outdoor.
 - h. Service Temperature: Minus 40 to plus 200 deg F.
 - i. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - j. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3. Water-Based Joint and Seam Sealant:
 - a. Application Method: Brush on.
 - b. Solids Content: Minimum 65 percent.
 - c. Shore A Hardness: Minimum 20.
 - d. Water resistant.
 - e. Mold and mildew resistant.
 - f. VOC: Maximum 75 g/L (less water).
 - g. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - h. Service: Indoor or outdoor.
 - i. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- 4. Flanged Joint Sealant: Comply with ASTM C 920.
 - a. General: Single-component, acid-curing, silicone, elastomeric.
 - b. Type: S.
 - c. Grade: NS.
 - d. Class: 25.
 - e. Use: O.

- f. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 5. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- 6. Round Duct Joint O-Ring Seals:
 - a. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 - b. Retain one or both subparagraphs below. These are proprietary seals provided on factory-fabricated, round duct fitting joints and constructed with specific dimensions to ensure a proper seal.
 - c. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 - d. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

E. FASTENERS

- 1. Rivets, bolts, or sheet metal screws.

2.2 INSULATED FLEXIBLE DUCTS

- A. UL 181, Class 1, mechanically-locked spun nylon fabric supported by helically wound spring steel wire; fiberglass insulation; fire retardant polyethylene vapor barrier film.
- B. Pressure Rating: 6 inches WG positive, 5.0 inches WG negative (through 16" diameter), 1.0' WG negative (18" to 20").
- C. Maximum Velocity: 5500 fpm.
- D. Temperature Range: -20 degrees F to 250 degrees F.
- E. Minimum Sound Attenuation Performance (Insertion Loss in dB of 12' Length of 12" Round Duct):
 - 1. 63 Hz Octave Band: 13
 - 2. 125 Hz Octave Band: 37
 - 3. 250 Hz Octave Band: 31
 - 4. 500 Hz Octave Band: 34
 - 5. 1 kHz Octave Band: 37
 - 6. 2 kHz Octave Band: 47
 - 7. 4 kHz Octave Band: 34
- F. Manufacturer: Flexmaster Type 6B or equivalent.

3. EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturer's instructions; SMACNA HVAC Duct Construction Standards - Metal and Flexible, current edition and International Mechanical Code requirements.

- B. Seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, current edition.
- C. Duct sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. Duct transition from round to rectangular and vice versa shall be made with rectangular to round duct transition fitting.
- E. Provide flange-type joint at transverse joints or seal as specified. All transverse joints shall be inspected by the Owner prior to insulating ductwork.

3.2 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install round and flat-oval ducts in maximum practical lengths.
 - a. Install round in lengths not less than 12 feet, unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- A. Support exterior ductwork routed vertically up the building with painted steel, aluminum or stainless steel wall bracket supports as required.
- B. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- C. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- D. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
 - 1. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system. Keep openings covered until ready for continuing duct run or final connections.

- E. Construct and install each duct system for the specific duct pressure classification indicated.
- F. Install only low loss high efficiency fittings at takeoffs. Extractors not allowed.
 - 1. Take-offs from rectangular main ducts shall be lo-loss 45°F take-offs.
 - 2. Diffusers and register take-offs from rectangular duct mains shall be lo-loss 45° fittings, with integral balancing damper that is provided with stand-off bracket and quadrant lock.
 - 3. Exhaust grille/register branch duct connections to rectangular mains shall be lo-loss 45° entry fittings with integral balancing damper.
- G. Install couplings tight to duct wall surface with a minimum of projections into duct.
- H. Install ducts with a clearance of 2 inch, plus allowance for insulation thickness.
- I. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- J. Verify location of air outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement. Refer to reflected ceiling plans, finish schedule, material finish specification, and shop drawings.
- K. Coordinate routing with all other trades to establish space requirements for each.
- L. Contractor may vary route and shape of ductwork and make offsets during progress of work if required to meet structural or other interferences. Where such changes impair the system performance, the changes will be corrected at Contractor's expense.
- M. All ductwork shall be substantially and neatly supported on galvanized steel straps or angles riveted or bolted to duct flanges and properly anchored to the construction so that horizontal ducts are without sag or sway, vertical ducts are without buckle, and all ducts are free from the possibility of deformation, collapse or vibration. Support at each joint and at 4 feet on center maximum.
- N. Openings required for ductwork through structural elements in new construction shall be coordinated with the General Contractor. Shop drawings locating such openings shall be prepared in ample time to meet the construction schedule.
- O. Provide sleeves at all duct penetrations through walls, floors and roofs. Openings through sound-rated partitions shall have annular space stuffed with fiberglass insulation for full thickness of wall.
- P. Provide 2-inch deep bitumastic coated drip pans on all non-ducted hoods, fans or penthouses used for relief or exhaust air service. Pans shall be 12 inches larger all around than roof opening with clear vertical openings between pan and structure as indicated. Insulate pan where indicated.
- Q. Where required on drawings, install automatic control dampers as recommended by the manufacturer.
- R. Prevent passage of unfiltered air around filters with felt, rubber, neoprene gaskets, or other approved safing material.

- S. Provide openings in ductwork to accommodate thermometers and controllers. Provide pitot tube openings for testing of systems, complete with metal cap with spring device or screw to prevent air leakage.
- T. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- U. Paint ductwork visible behind wall-mounted air outlets and inlets matte black.
 - 1. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.
- V. Change duct sizes gradually, not exceeding 30 degrees (15 degrees ideally) divergence and 45 degrees (30 degrees ideally) convergence.
- W. Use crimp joints with or without bead for joining round duct sizes 8 inches and smaller and install with crimp in direction of air flow.
- X. Provide return air grilles open to ceiling plenum with duct boot with minimum longitudinal dimension 2' X 2'.
- Y. Provide flexible connect between ductwork and all moving equipment.
 - 1. Provide 1-inch slack for free movement.
- Z. Connect flexible ducts to metal ducts with stainless steel bands with worm gear tightener, nylon bands are unacceptable.
 - 1. Connection to metal ducts shall be in accordance with installation requirements outlined in the Air Diffusion Council's Flexible Duct Performance & Installation Standards, Current Edition. Worm gear tightener shall be used to secure flexible duct core to metal duct. Jacket and insulation shall be pulled back over inner core and taped with minimum 2 wraps of tape.
- AA. Unless otherwise noted, provide maximum of 6' of flexible duct upstream of each diffuser or grille. See details on Drawings.
- BB. Cover all exposed fiberglass insulation with duct tape.
- CC. Exterior Ductwork:
 - 1. Slope top of rectangular ductwork to allow proper drainage.
 - 2. Utilize PHP systems or equivalent equipment pad supports with galvanized channels for exterior ductwork. For support loading and spacing, use manufacturer recommendations.

3.3 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
 - D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
 - E. Repair or replace damaged sections and finished work that does not comply with these requirements.
 - F. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
 - G. Provide closure flanges around exposed ductwork at wall and ceiling penetrations, 1-1/4 inches wide minimum.
- 3.4 INSTALLATION OF 2" AND GREATER PRESSURE CLASS DUCTWORK (POSITIVE OR NEGATIVE PRESSURE)
- A. All round and oval duct elbows installed shall be die-formed, gored, pleated or mitered.
 - B. All mitered elbows shall be equipped with turning vanes.**
 - C. On round and oval ducts, provide 45 deg wye or 90 deg conical tee take-offs as indicated on plans. Straight taps are not acceptable.
 - D. All diverging flow fittings shall be constructed such that no excess material projects from the body into the branch tap entrance.
 - E. Transverse joints of all rectangular ducts greater than 24" wide or deep shall be fabricated with flanging system as called out previously (Ductmate or equivalent).
- 3.5 INSTALLATION OF 1" AND LESS PRESSURE CLASS DUCTWORK (POSITIVE OR NEGATIVE PRESSURE)
- A. All round duct elbows installed shall be of the adjustable, die-formed, gored, pleated or mitered type. All adjustable elbows shall be sealed after installation.
 - B. All mitered elbows shall be equipped with turning vanes.**
 - C. Connect ceiling diffusers to low pressure ducts with adjustable elbow at duct and short length of flexible duct held in place with strap or clamp. Do not use flexible duct to change direction. Connection detail as well as maximum length of flex duct allowed to diffusers is indicated on the plans.
- 3.6 CLEANING

- A. **The air handling units, energy recovery wheel, exhaust fans, and other HVAC airside equipment shall not be used for temporary building conditioning without the written permission from the Owner and Architect/Engineer.** Open ductwork that has been installed shall be protected during the duration of the project with polyethylene plastic and duct tape over the open ends. Uninstalled ductwork shall be protected from construction dust by covering the uninstalled ductwork with polyethylene plastic. Prior to installing ductwork, the inside of the ductwork shall be wiped down or vacuumed.
- B. Clean inside all air handling units, energy recovery units, and outside air duct systems before the fans are turned on. Call for inspection by the owner's representative to verify that all ducts are cleaned. If the ductwork is unacceptable, the contractor shall provide vacuuming of these duct systems by forcing air at high velocity through duct where manual cleaning is not possible due to duct lengths or size. Call for re-inspection by Owner's representative.
- C. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- D. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
- E. Use service openings, as required, for physical and mechanical entry and for inspection.
- F. Call for inspection by Owner's representative and provide documentation of owner approval to engineer and include copy in maintenance manuals.
- G. Install a fresh set of filters in all equipment immediately prior to project turnover.

3.7 DUCTWORK SCHEDULE

Duct System:	Material:	Longitudinal Joints:	Transverse Joints:	Pressure Class:	Sealant Class:	Leakage Class:	Additional Notes:
Rectangular SA system	Galv. Steel	3A, 3B, 3E	4A, 4C, 4D	+2"	A	12	8B
Round SA system	Galv. Steel	3C, 3E	4B, 4D	+2"	A	6	8B
Rectangular general EA or RA system	Galv. Steel	3A, 3B, 3E	4A, 4C, 4D	-2"	A	24	8B
Round general EA or RA system upstream	Galv. Steel	3C, 3E	4B, 4D	-2"	A	12	8B, 8C

DUCTWORK SCHEDULE NOTES:

Longitudinal Joint Options:

- 3A: Pittsburgh lock. Refer to Figure 1-5, SMACNA.
- 3B: Button punch snap lock. Refer to Figure 1-5, SMACNA.
- 3C: Spiral lockseam.
- 3E: Welded.
- 3F: Double-wall, pre-manufactured sheet metal plenum.
- 3G: Butt-welded, fully-welded around entire perimeter of joint from outside in accordance with IMC.

Transverse Joint Options:

- 4A: Pre-manufactured flanged duct connection system specified under “Products” section of this specification.
- 4B 0-24” Major Axis Diameter: Interior slip coupling beaded at center, fastened to duct with sealing compound applied continuously around joint before assembling and after fastening.
26” Major Axis Diameter and Up: Pre-manufactured flanged duct connection system specified under “Products” section of this specification.
- 4C: Any standard transverse joint as shown in Figure 1-4 of SMACNA is acceptable.
- 4D: Welded
- 4E: Fully-welded at all joints from outside in accordance with IMC.

Sealant Class Options:

- 6: Seal class is defined by the following table (refer to Table 4-1, SMACNA HVAC Air Duct Leakage Test Manual):

Seal Class:	Sealing Required:
A	All transverse joints, longitudinal seams, and ductwork penetrations. Pressure sensitive tape shall not be used as a primary sealant on metal ducts.
B	All transverse and longitudinal seams. Pressure sensitive tape shall not be used as a primary sealant on metal ducts.
C	Transverse joints only.

Leakage:

- 7: Leakage Class is defined by Figure 4-1, SMACNA HVAC Air Duct Leakage Test Manual.

Additional Comments:

- 8A: See Drawings for further information regarding extent of stainless steel ductwork.
- 8B: Field welded ductwork is to be welded with filler rod of the same material as the metal that is being welded. Field coat welded joints with protective paint to prevent damage to galvanized surfaces.
- 8C: **Regardless if allowable by SMACNA, Snaplock longitudinal joints shall not be used for round ductwork.**

3.8 PRESSURE TESTING

- A. Perform and complete the following field tests, inspections, and test reports according to SMACNA’s “HVAC Air Duct Leakage Test Manual”:
 - 1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days’ advance notice for testing.
 - 3. Maximum Allowable Leakage: Refer to paragraph 3.7.
 - 4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.
 - 5. Test no less than
 - a. 25% of the supply air ductwork upstream of terminal units
 - b. 25% of the return air ductwork downstream of terminal units
 - c. 25% of the exhaust air ductwork downstream of terminal units
 - 6. Submit completed test reports to engineer and include copy in maintenance manual.

END OF SECTION 23 31 13

SECTION 23 33 00 - DUCTWORK ACCESSORIES

1. GENERAL

1.1 SECTION INCLUDES

- A. Turning vanes.
- B. Duct test holes.
- C. Flexible duct connections.
- D. Manual balancing dampers.
- E. Gravity backdraft dampers.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. References.
- B. Submittals.
 - 1. Product Data: For each type of product.
 - a. Include diagrams for power, signal, and control wiring.
- C. Project record documents.
 - 1. Record actual locations of access doors, test holes etc.
- D. Qualifications.
 - 1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- E. Regulatory requirements.
 - 1. Products Requiring Electrical Connection: UL Listed and classified.
- F. Delivery, storage, and handling.

2. PRODUCTS

2.1 TURNING VANES

- A. General:

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vaness and Vane Runners," and 4-4, "Vane Support in Elbows."
 2. Note that air extractors or "scoops" shall not be used under any circumstances.
- B. Manufactured and Fabricated Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
 2. Single-Thickness Vane Construction: Vanes shall be single-thickness, quarter-circle shape with 2" radius, minimum 3.15" length, and spaced 1.5" on center.
 3. Double-Thickness Vane Construction: Vanes shall be double-thickness, quarter-circle shape, with 4.5" radius and spaced 3.25" on center.
 4. Single wall for ducts up to 48 inches wide and double wall for larger dimensions.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

2.2 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.3 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches to 5-3/4 inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Provide metal compatible with connected ducts.
1. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - a. Minimum Weight: 26 oz./sq. yd.
 - b. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - c. Service Temperature: Minus 40 to plus 200 deg F.
 2. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - a. Minimum Weight: 24 oz./sq. yd.

- b. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - c. Service Temperature: Minus 50 to plus 250 deg F.
3. Fan Discharge Flexible Connectors: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
- a. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - b. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - g. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.4 MANUAL BALANCING DAMPERS

A. General:

- 1. Suitable for horizontal or vertical applications.
- 2. Fabricated in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- 3. Dampers shall have axles full length of damper blades and bearings at both ends of operating shaft.

B. Single Blade Dampers:

- 1. Ruskin models MD25 (rectangular), MDRS25 (round) or equivalent.
- 2. Fabricate for duct sizes up to 6 x 30 inch.
- 3. Frame: 20 gauge galvanized steel, 6" wide.
- 4. Blade: 20 gauge galvanized steel.
- 5. Control shaft / hand quadrant: 3/8" square axle shaft extending beyond frame through factory mounted, locking hand quadrant.
 - a. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Regulator shall be equivalent to Sheet Metal Connectors Model RP-3, with heavy-gauge steel regulator, wing nut locking assembly, and stamped dial indicating damper position.
 - b. On externally insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters to avoid damaging or compression of insulation.
- 6. Bearings: Molded synthetic.
- 7. Finish: Mill galvanized.
- 8. Maximum velocity: 1500 fpm.
- 9. Maximum temperature: 250 deg F.

C. Multi-Blade Damper:

1. Ruskin model MD35 or equivalent.
2. Frame: 5" x 1" x 16 gauge galvanized steel channel with corner braces. Low profile top and bottom 3-1/2" x 3/8" x 16 gauge galvanized steel channel 13" high and under, actual.
3. Blade: 8" maximum width 16 gauge galvanized steel, opposed blade.
4. Blade stop: 20 gauge galvanized steel.
5. Finish: Mill galvanized.
6. Linkage: Exposed or concealed as recommended by manufacturer.
7. Axles: 1/2" hex.
8. Bearings: Molded synthetic.
9. Control shaft: 3" x 3/8" square plated steel, 1/2" dia. Jackshaft for multisection dampers.
 - a. Jackshaft to operate multi-section damper from one side.
10. Temperature limits: -40 deg F min. to 240 deg F max.
11. Quadrants:
 - a. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Regulator shall be equivalent to Sheet Metal Connectors Model RP-3, with heavy-gauge steel regulator, wing nut locking assembly, and stamped dial indicating damper position.
 - b. On externally insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters to avoid damaging or compression of insulation.
 - c. Where rod lengths exceed 30 inches, provide regulator at both ends.

2.5 TAKEOFFS

- A. Manufactured high-efficiency takeoff with 45-degree slope on the body, with gauge thickness equal to adjacent ductwork.
 1. Damper may be provided with high-efficiency takeoff pending conformance with product requirements for manual balancing dampers.

2.6 GRAVITY BACKDRAFT DAMPERS

- A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 16 gage thick extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

3. EXECUTION

3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 13 for duct construction and pressure class.

- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts and stainless-steel accessories in stainless-steel ducts.
- C. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. Downstream from control dampers, backdraft dampers, and equipment.
 - 2. Control devices requiring inspection.
 - 3. Elsewhere as indicated.
- D. Unless duct access door size is explicitly indicated, provide minimum 24 x 18 inch size duct access doors wherever possible. Provide 18 x 18, 12 x 12 inch or 8 x 8 inch size elsewhere, using the largest size possible.
- E. Install access doors with swing against duct static pressure.
- F. Provide duct test holes where indicated and required for testing and balancing purposes. Install with minimum 24" clear dimension from any side wall or other obstruction.
- G. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators. Install flexible connectors with adequate flexibility to allow for all thermal, axial, transverse and torsional movement. Provide airtight seal.
- H. Provide balancing dampers at points on supply, return, and exhaust systems where indicated on plans.
- I. Set dampers to fully open position before testing, adjusting, and balancing.
- J. Provide a high-efficiency takeoff with 45-degree entry for each branch connection.
- K. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
- L. The use of splitter dampers is not acceptable.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 33 00

SECTION 23 34 23 - POWER VENTILATORS

1. GENERAL

1.1 SECTION INCLUDES

- A. Exhaust fans.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. References.
- B. Submittals.
 - 1. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, sound power levels at rated capacity, and electrical characteristics and connection requirements.
 - 2. Manufacturer's Installation Instructions.
- C. Operation and maintenance data.

1.3 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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.4 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

2. PRODUCTS

2.1 EXHAUST FANS

- 1. Basis-of-Design Product: Greenheck
- B. Alternative Manufacturers: Subject to compliance with requirements, provide one of the following:

1. Loren Cook
2. Twin City
3. Or equivalent.

C. General Description

1. Downblast fan shall be for roof mounted applications
2. Maximum continuous operating temperature is 180 Fahrenheit (82.2 Celsius)
3. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

D. Wheel

1. Constructed of aluminum
2. Non-overloading, backward inclined centrifugal
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

E. Motors

1. Electronically Commutated Motor
 - a. Motor enclosures: Open type
 - b. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
 - c. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 - d. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
 - e. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
 - f. Motor shall be a minimum of 85% efficient at all speeds.

F. Housing

1. Motor cover, shroud, curb cap, and lower windband shall be constructed of heavy gauge aluminum
2. Shroud shall have an integral rolled bead for extra strength
3. Shroud shall be drawn from a disc and direct air downward
4. Lower windband shall have a formed edge for added strength
5. Motor cover shall be drawn from a disc
6. All housing components shall have final thicknesses equal to or greater than preformed thickness.
7. Curb cap shall have pre-punched mounting holes to ensure correct attachment
8. Rigid internal support structure
9. Leak proof

G. Housing Supports and Drive Frame:

1. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators

H. Vibration Isolation:

1. Rubber isolators
2. Sized to match the weight of each fan

I. Disconnect Switches

1. NEMA rated: 3R
2. Positive electrical shut-off
3. Wired from fan motor to junction box installed within motor compartment

J. Options/Accessories:

1. Birdscreen:

- a. Material Type: Aluminum
- b. Protects fan discharge

2. Dampers:

- a. Type: Gravity
- b. Prevents outside air from entering back into the building when fan is off
- c. Balanced for minimal resistance to flow
- d. Galvanized frames with prepunched mounting holes

3. Hinge Kit:

- a. Aluminum hinges
- b. Allows the fan to tilt away for access to wheel and ductwork for inspection and cleaning

4. Variable Frequency Drive

- a. Factory programed, mounted and wired
- b. Input speed control: Potentiometer dial
- c. 24VDC damper power output
- d. 24VDC control power output
- e. Motor: (VFD Rated) compatible with induction and permanent magnet motors
- f. Parameters of acquainted motor shall be set to include voltage, speed, FLA, acceleration/deceleration time, and minimum & maximum motor frequency
- g. R³ Filtering for harmonic mitigation
- h. NEMA 4X Enclosure
- i. LED indication for Power, Run, and Fault

3. EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions

3.2 EXAMINATION

- A. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected

3.3 PREPARATION

- A. Ensure duct openings are square, accurately aligned, correctly located, and in tolerance
- B. Ensure duct is plumb, sized correctly, and to proper elevation above roof deck. Install duct as specified in Air Distribution (Division 23)

3.4 INSTALLATION

- A. Install fans system as indicated on the Installation, Operation and Maintenance Manual (IOM) and contract drawings
- B. Install fans in accordance with manufacturer's instructions

3.5 SYSTEM STARTUP

- A. Refer to Installation, Operation, and Maintenance Manual (IOM)

3.6 ADJUSTING

- A. Adjust exhaust fans to function properly
- B. Adjust Belt Tension
- C. Lubricate bearings
- D. Adjust drive for final system balancing
- E. Check wheel overlap

3.7 CLEANING

- A. Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction

3.8 PROTECTION

- A. Protect installed product and finished surfaces from damage during construction

- B. Protect installed exhaust fans to ensure that, except for normal weathering, fans will be without damage or deterioration at time of substantial completion

END OF SECTION 23 34 23

SECTION 23 37 00 - AIR OUTLETS AND INLETS

1. GENERAL

1.1 SECTION INCLUDES

- A. Diffusers.
- B. Registers/grilles.

1.2 REFERENCES

- A. See Section 23 05 00.

1.3 SUBMITTALS

- A. See Section 23 05 00.
- B. Product Data: For each type of product.
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Device Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 PROJECT RECORD DOCUMENTS

- A. See Section 23 05 00.

1.5 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.
- B. Test and rate louver performance in accordance with AMCA 500. Submit AMCA certification with submittal.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

2. PRODUCTS

2.1 Basis-of-Design Products: Titus

2.2 Alternative Manufacturers: Subject to compliance with requirements, provide one of the following:

1. Price
2. Krueger HVAC
3. Or equivalent.

2.3 CEILING DIFFUSERS

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
- D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule.

2.4 WALL REGISTERS AND GRILLES

- A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.
- C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.
- D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.

3. EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

- C. Install diffusers to ductwork with adjustable elbow. Install maximum length of 5' of flexible duct upstream of each diffuser and grille, unless otherwise noted. See details on Drawings. All connections shall be air tight.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly. Where a balancing damper has been omitted from drawing, consult engineer.
- E. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION 23 37 00

SECTION 23 74 13 – PACKAGED ROOFTOP UNITS

1. GENERAL

1.1 REFERENCES

- A. UL 60335-2-40 - Standard for Safety, Household and Similar Electrical Appliances - Safety - Part 2-40.
- B. AHRI 210 / 240 - Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment
- C. AHRI 340 / 360 - Performance Rating of Commercial and Industrial Unitary Air-conditioning and Heat pump Equipment
- D. ASHRAE 90.1 - Energy Standard for New Buildings Except Low-Rise Residential Buildings
- E. California Administrative Code - Title 24
- F. AHRI 270 or 370 Sound Rating of Outdoor Refrigeration and Air Conditioning Equipment, as applicable.
- G. Gas-fired heaters shall comply with ANSI Z21.47 and 10 CFR Part 431 for Commercial Warm Air furnaces.

1.2 SUBMITTALS

- A. Submit drawings indicating components, dimensions, weights and loadings, required clearances, and location and size of field connections.
- B. Submit product data indicating rated capacities, weights, accessories, service clearances and electrical requirements.
- C. Submit manufacturer's installation instructions.

1.3 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, start-up and operating instructions, installation instructions, and maintenance procedures.

1.4 HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Protect units from physical damage. Leave factory shipping covers in place until installation.

1.5 WARRANTY

- A. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first (ALL EQUIPMENT).
- B. OEM provides several Extended Warranty options to include:
- C. Whole Units Parts Warranty (Year 2 plus)
- D. Compressor Parts or Gas Heater Exchanger Parts Option
- E. Whole Unit Labor Warranty (Year 1 plus)
- F. Compressor Warranty Option
- G. Refrigerant Warranty Option

1.6 MAINTENANCE SERVICE

- A. All work on units shall be accomplished by OEM factory trained and authorized servicing technicians.

1.7 SUMMARY

- A. The contractor shall furnish and install packaged rooftop air conditioning unit(s) as shown and as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the conditions specified, scheduled or as shown on the contract drawings.

2. PRODUCTS - GENERAL

2.1 Casing

- A. Unit casing shall be zinc coated, heavy gauge, galvanized steel.
- B. Weather resistant painted metal with galvanized substrate.
- C. Meets ASTM B117, 672 hour salt spray test.
- D. Removable single side maintenance access panels.
- E. Exposed vertical panels and top covers in the indoor air section insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material.
- F. Base pan with no penetrations within the perimeter of the curb other than the raised 1-inch downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up.
- G. Base of the unit insulated with 1/8-inch, foil-faced, closed-cell insulation.

- H. Unit base provisions for forklift and/or crane lifting on three sides of unit.

2.2 Microchannel Coils

- A. Optimal heat transfer performance due to flat, streamlined tubes with small ports, and metallurgical tube to fin bond.
- B. Reduce system refrigerant charge by up to 50 percent leading for better compressor reliability.
- C. All-aluminum construction minimizes galvanic corrosion.
- D. Strong aluminum brazed structure provides better fin protection.
- E. Flat streamlined tubes more dust resistant and easy to clean.
- F. Coils leak tested at the factory to verify the pressure integrity.

2.3 Fin and Tube Coils (heat pump only)

- A. Heat pump units shall have internally finned, 5/167-inch copper tubes, mechanically bonded to a configured aluminum plate fin.
- B. Assembled coil shall be factory leak tested to 600 psi.
- C. Assembled unit shall be leak tested to 465 psi.

2.4 Coil Guards

- A. Provides condenser coil protection.

2.5 Compressors

- A. All units have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps.
- B. Suction gas-cooled motor with voltage utilization range of plus or minus 10 percent of unit nameplate voltage.
- C. Internal overloads shall be standard with scroll compressors.
- D. Crankcase heaters shall be standard on all compressors.
- E. 3-5 ton standard efficiency units shall have 1 stage of cooling. 3-5T high efficiency units shall have 2 stages of cooling. All 6-17.5 ton unit shall have 3 stages of cooling. All 20-25 ton units shall have 4 stages of cooling.

2.6 Units with Variable Speed Compressor systems

- A. All unit have a variable speed compressor matched with a variable frequency drive that modulated the speed of the compressor motor.
- B. Compressor motors shall include permanent magnet motor with voltage utilization range of plus or minus 10 percent of unit nameplate voltage.
- C. 3-15 ton units shall have a single variable speed compressor. Units 17.5 to 25 ton shall have a single variable speed compressor manifolded to a fixed speed compressor.
- D. Variable speed modulation to 15 HZ equating to 27% or less of full capacity.
- E. Variable speed shall be commanded by the unit controller and shall be based on the temperature offset to space temp set point.

2.7 Filters

- A. Standard 2-inch filters.
- B. Optional 2-inch MERV 8 and MERV 13 filters.

2.8 Froststat™

- A. Froststat shall be standard on all units.

2.9 Gas Heating Section

- A. Gas heating section includes a tubular heat exchanger in low, medium and high heat capacities and shall be made of corrosion-resistant aluminized steel tubes and burners.
- B. Burner system shall have an induced draft combustion blower.
- C. Heater uses a direct spark ignition (DSI) system and a flame sensor.
- D. Units are designed for use with natural gas or propane (field-installed propane conversion kit).
- E. Manufacturer shall offer optional stainless steel heat exchanger with 409 stainless steel tubes and 439 stainless steel burners. Optional stainless steel heat exchanger shall have a 15 year warranty.

2.10 Indoor Fan

- A. 3-5T standard eff and 3T high efficiency units shall have direct drive forward curve fan.
- B. Where 3-5T includes variable speed compressors, supply fans shall be direct drive plenum with ECM motors.
- C. All other models shall have direct drive plenum fans with ECM motors. Plenum fan shall be backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor.

- D. Plenum fan design – backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor.
- E. Supply fan speed adjustments can be made using the unit controller or using a manufacturer supplied app. The connection between the unit control and the app shall be Bluetooth.
- F. Motors are electronically protected.

2.11 Powered or Unpowered Convenience Outlet

- A. Powered GFCI, 120V/15A, 2 plug, convenience outlet or unpowered GFCI, 120V/20A, 2 plug, convenience outlet shall be available.
- B. Powered outlets must include a service receptacle disconnect. This outlet shall be powered from the line side of the disconnect or circuit breaker, and will remain powered when the disconnect or circuit breaker is in the open position.

2.12 Stainless Steel Drain Pan

- A. Optional factory installed, 304 stainless steel drain pan shall be available.

2.13 Optional Through-the-Base Electrical with Circuit Breaker

- A. Optional through the base electrical with circuit breaker shall include thermal magnetic, molded case, and shall be HACR labeled (Heating / Air-Conditioning / Refrigeration).
- B. Circuit breaker installed within unit in water tight enclosure.
- C. Wiring provided from the switch to the unit high voltage terminal block.
- D. Circuit breaker will provide overcurrent protection, sized per NEC and cULus guidelines, and agency recognized by cULus.

2.14 Through-the-Base Electrical with Disconnect Switch

- A. Optional 3-pole, molded case, disconnect switch with provisions for through-the-base electrical connections shall be available.
- B. Disconnect switch installed within unit and shall be protected from outdoor elements.
- C. Wiring shall be provided from the switch to the unit high voltage terminal block.
- D. Switch shall be cULus recognized.
- E. Provided disconnect switch does not satisfy the need for overcurrent protection. When disconnect switch is factory provided, overcurrent protection shall be provided by others.

2.15 Through-the-Base Gas Piping

- A. Optional through-the-base gas provisions shall be available. Piping shall include black steel manual gas shut-off valve, elbows, and union.
- B. Manual shutoff valve shall have 1/8-inch NPT pressure tap.

2.16 Economizer

- A. Economizer shall be available with or without barometric relief. It shall be fully modulating from 0 to 100 percent and shall include provision for a minimum position setting. Assembly also includes, preset linkage, wiring harness with plug, and spring return actuator.
- B. Barometric relief provides a pressure-operated, gravity-closing damper.
- C. Barometric relief prevents entrance of outside air during the equipment off cycle.
- D. Control options include dry bulb, differential dry bulb, reference enthalpy, or comparative enthalpy.
- E. A standard discharge air sensor shall be included on all units with economizers.
- F. Optional low leak economizer shall meet the low leak requires of ASHRAE 90.1, IECC, and CA Title 24 (4 CFM/sq. ft. @ 1" Wg exterior air/return air).

2.17 Electric Heaters

- A. Electric heaters shall be nickel chromium elements and will be delta connected for 240V and wye connected for 480V and 600V.
- B. Heater staging is commanded by the unit microprocessor control.
- C. Heater shall include at least one automatic reset high temperature device and a single operation high temperature limit control.
- D. Heaters shall be individually fused from the factory and shall be wired such that the unit electrical connection is a single-point connection.

2.18 Manual Outside Air Damper

- A. Rain hood and screen provide up to 50 percent outside air.

2.19 Motorized Outside Air Damper

- A. If optional motorized outside air damper is provided, when indoor fan starts the outdoor air dampers open to set position. The damper fully closes when the indoor fan shuts down.

2.20 Power Exhaust

- A. Manufacturer shall offer optional power exhaust of return air. When power exhaust is factory provided, the MCA and MOP shown on the unit rating plate shall include the electrical characteristic of the power exhaust unit.

2.21 Ventilation Override Operation

- A. Unit can be set to transition up to 3 different pre-programmed sequences for smoke purge, pressurization, and exhaust.

2.22 Leak Detection Sensors

- A. Unit shall be furnished with a leak detection system from the factory when a circuit refrigerant charge exceeds 3.91 lbs. The leak detection system shall consist of one or more refrigerant detection sensors. When the system detects a leak, the unit controller shall initiate mitigation actions.

2.23 Unitary Controls

- A. See Section 23 09 93 – Sequence of Operations for more information.

3. ACCESSORIES

3.1 Roof Mounting Curb

- A. Roof mounting curb shall be heavy gauge zinc coated steel with nominal two-inch by four-inch nailer setup. Supply/return air opening gasketing shall be provided. Curb shall ship knocked down for easy assembly. Channel shall be provided to allow for adjustment of return air opening location. Curb shall be manufactured to National Roofing Contractors Association guidelines.

3.2 Electronic Zone Sensors

- A. Remote Sensor shall be available to be used for remote zone temperature sensing capabilities when zone sensors are used as Remote panels
- B. Integrated Comfort System sensors shall be available with sensor only, sensor with timed override, and sensor with local temperature setpoint adjustment with timed override.
- C. Humidity Sensor - Monitors the humidity levels in the space for 1) Humidification and/or 2) Modulating Hot Gas Reheat.

4. EXECUTION

4.1 EXAMINATION

- A. Verify that proper power supply is available.

4.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Mount units on concrete equipment pad. Install unit level.

4.3 MANUFACTURER'S FIELD SERVICES

- A. Provide initial start-up and shut-down during first year of operation, including routine servicing and check-out.
 - 1. Provide services of factory trained representative for start-up, leak test, refrigerant pressure test, evacuate, dehydrate, charge, start-up, calibrate controls, and instruct Owner on operation and maintenance.
- B. The contractor shall furnish manufacturer complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.

END OF SECTION 23 74 13

SECTION 26 00 00 - ELECTRICAL WORK

1. GENERALS

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. The work included under this Section consists of providing all labor, materials, supervision, and construction procedures necessary for the installation of the complete electrical systems required by these specifications and/or shown on the drawings of the contract.

1.3 QUALITY ASSURANCE

- A. Installers shall have at least 2 years of successful installation experience on projects with electrical installation work similar to that required by the project. All equipment and materials shall be installed in a neat and workmanlike manner, shall be complete in both effectiveness and appearance, whether finally concealed or exposed and shall be executed by experienced mechanics.
- B. All materials shall be new, unused, and unweathered, and of the quality specified. Materials shall be standard products of manufacturer's regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.
- C. All equipment and materials shall be installed in a neat and workmanlike manner, shall be complete in both effectiveness and appearance, whether finally concealed or exposed and shall be executed by experienced mechanics.

1.4 REFERENCES

- A. The electrical work shall conform to the following codes, standards and regulations:
 - 1. Safety and Health Regulations for Construction.
 - 2. Occupational Safety and Health Standards, National Consensus Standards and Established Federal Standards.
 - 3. National Electrical Code (NEC).
 - 4. American National Standards Institute (ANSI).
 - 5. National Electric Manufacturer's Association (NEMA).
 - 6. National Fire Protection Association (NFPA).
 - 7. Insulated Cable Engineers Association (ICEA).
 - 8. American Society for Testing and Materials (ASTM).
 - 9. Life Safety Code NFPA #101.
 - 10. Underwriters Laboratories, Inc. Standards (UL).
 - 11. National Electrical Safety Code (NESC).
- B. The latest adopted edition by the local and state inspection authorities of all standards and specifications listed above shall apply.

- C. Furthermore, the electrical work shall be in accordance with all applicable national and state standards, and local codes and building ordinances. The electrical work shall merit the approval of the enforcing authorities having jurisdiction.

1.5 ACCESS TO EQUIPMENT

- A. Starters, switches, receptacles, pull boxes, etc., shall be located to provide easy access for operations, repair and maintenance. If the devices listed above are concealed, access doors shall be provided.

1.6 PERMITS AND FEES

- A. The Contractor shall pay for all permits and/or fees required for the work.

1.7 SHOP DRAWINGS

- A. The Contractor shall furnish shop drawing portfolios and proper transmittal forms for all materials, equipment, and lighting fixtures to be incorporated in the work, in accordance with the General Conditions, Supplementary Conditions, and all other applicable Conditions.
- B. Shop drawings on component items forming a system or that are interrelated shall be submitted at one time as a single submittal in order to demonstrate that the items have been properly coordinated and will function properly as a system. A notation shall be made on each shop drawing submitted as to the items specific use, either by a particular type number referenced on the drawings or in the specifications, or by a reference to the applicable paragraph of the specifications or by a description of its specific location. The shop drawings shall be organized and bound into sets with each set collated.
- C. The Engineer shall have the final authority as to whether the equipment or material submitted is equal to the specified item. Proposed substitutions may be rejected for the aesthetic reasons if felt necessary or desirable. In the event the proposed substitutions are rejected, the Contractor shall furnish the specified item.

2. CONDUCTORS

- 2.1 Except as otherwise indicated, provide wire, cable and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, and as required for the installation.
- 2.2 All conductors shall be 600 volt and shall be copper, soft drawn, annealed, having a conductivity of not less than 98% pure copper with dual rated type THHN/THWN insulation unless otherwise specified or indicated on the drawings. Aluminum conductors shall not be substituted for copper conductors.
- 2.3 No wire shall be smaller than No. 12, except wiring for signal and pilot control circuit, and pre-manufactured fixture whips for light fixtures.
- 2.4 All wire No. 12AWG shall be solid unless otherwise indicated. All wire No. 10 AWG and larger shall be stranded.
- 2.5 All wiring installed in light poles or other areas subject to vibration shall be stranded.

2.6 Wire sizes shown are minimum based on code requirements, voltage drop and/or other considerations. Larger sizes may be installed at the Contractor's option to utilize stock size, provided conduit sizes are increased where necessary to conform to the National Electrical Code. Sizes of wires and cables indicated or specified are American Wire Gage (Brown and Sharpe).

2.7 All wires shall be installed in conduit.

2.8 Conductors shall be continuous from outlet to outlet and no splices shall be made except within outlet or junction boxes. Junction boxes may be used where required. No splicing or joints will be permitted in either feeder or branch circuits except at outlet or accessible junction boxes.

3. GROUNDING

3.1 Provide a separate green equipment ground conductor in all electrical raceways, connecting them to the building system ground.

3.2 Grounding and bonding of electrical circuit and equipment shall be accomplished as set forth in the NEC.

3.3 Ground HVAC ductwork and equipment to the C.O. equipment ground. (Not C.O. ground window). Use No. 6 insulated conductor.

4. RACEWAYS

4.1 Steel Conduit. Rigid steel conduit, intermediate metal conduit and steel electric metallic tubing shall be hot dipped, galvanized as manufactured by Youngston Sheet and Tube Company, National Electric or equal.

4.2 Rigid heavy wall (Schedule 40) PVC conduit may be used only for direct burial in earth and embedding in concrete. PVC conduit shall be installed as recommended by manufacturer.

4.3 Flexible metal conduit shall conform to UL1, and shall be formed from a continuous length of spirally-wound, interlocked zinc-coated strip steel. Flexible metal conduit may be used to connect light fixtures in accordance with NEC requirements but must be limited to a maximum of 6'-0" in length. Provide flexible metal conduit for connections to motors, transformers, generators, and other equipment subject to vibration. Flexible metal conduits shall not be permitted for any other applications, unless specifically approved by the engineer.

4.4 Pre-wired armored cabling, types AC or MC are not allowed.

4.5 Raceways shall be installed concealed. Provide metallic raceways continuous from outlet to outlet, and from outlets to cabinets, junction or pull boxes. Enter and secure conduit to all boxes to provide electrical continuity from the point of service to outlets. Wiremold shall be used only after Owner's approval. Wiremold shall be painted to match walls, or in accordance with the Architects' direction.

4.6 Raceways embedded in concrete or in earth below floor slabs shall be rigid steel conduit, intermediate metal conduit or rigid schedule 40 PVC conduit. Rigid PVC conduit shall be provided with rigid metal or intermediate metal conduit elbows when the raceway system exits the concrete topping or earth.

- 4.7 Raceways in outside walls (excluding building perimeter) or in refrigerated areas shall be rigid steel conduit, or intermediate metal conduit.
- 4.8 Provide rigid steel conduit or intermediate metal conduit for exposed raceways from floor to eight feet above the floor in mechanical rooms and in areas designated on the plans.
- 4.9 Joints. Raintight non-insulated throat type compression fittings (connectors and couplings) shall be provided for electrical metallic tubing systems. All fittings shall be of the steel type with steel locknuts equal to Appleton 95 Series. Compression joints shall be made up mechanically secure and snug so as to take continuous current-carrying electrical contacts.
- 4.10 Provide marking of conduit and junction boxes to indicate which distribution system they are serving. Concealed junction boxes shall be legibly marked with a magic marker to indicate the panel and circuit number that junction box serves.

5. WIRING DEVICES

- 5.1 All wiring devices shall be suitable for intended purpose and shall be UL listed.
- 5.2 All devices shall be located as shown on the drawings except that where practicable, devices shall be located in center of panels or trim or otherwise symmetrically located to conform with existing structural layout. Devices incorrectly installed shall be corrected. Damaged items or damaged finishes shall be repaired or replaced at no expense to the Owner.
- 5.3 Devices shall be set plumb or horizontal and shall extend to the finished surface of the walls, ceiling or floor, as the case may be, without projecting beyond same.
- 5.4 Receptacles, switches, etc., shown on wood trim, cases or other fixtures shall be installed symmetrically; and, where necessary, shall be set with the long dimensions of the plate horizontal, or ganged in tandem.
- 5.5 Where dimmer switches are shown adjacent to standard switches, both shall be installed in separate back boxes with adequate space between so that neither coverplate requires cutting.
- 5.6 Where devices are shown near wall openings, coordinate location if corner guards are to be installed so that coverplates do not require cutting.
- 5.7 Where shown on the drawings, furnish and install wiring devices indicated by the appropriate symbols. Wiring devices shall be products of Pass & Seymour Corporation, or equal. Catalog numbers shown below are Pass & Seymour hard use specification grade. Equal devices manufactured by Hubbell or Leviton shall be acceptable.

A. Switches. Branch circuit switches shall be flush tumbler type as follows:

1. Single Pole	CSB20AC1 Series – Gray
2. Two Pole	CSB20AC2 Series – Gray
3. Three-Way	CSB20AC3 Series – Gray
4. Four-Way	CSB20AC4 Series – Gray
5. Single Pole SW With Pilot	CSB20-AC1-RPL Series

6. Dimmer Switches: Provide dimmer switches capable of 0-10 Volt dimming of LED and fluorescent loads, Lutron NTF-10-277-Gray or engineer approved equal. Provide adequate number of conductors between dimmer switches and dimmed fixtures regardless of circuiting shown on drawings.
7. Switches fed by a generator circuit (standby or life safety) shall be as shown above, but red in color.

B. Occupancy Sensors/Switches and Time Switches

1. Wall Mounted Line Voltage Dual Technology Occupancy Sensing Switches (1-button):
Watt Stopper type DW-100-G-120/277-Gray with time delay set at 15 minutes.
2. Wall Mounted Line Voltage Dual Technology Occupancy Sensing Switches (2-button):
Watt Stopper type DW-200-G-120/277-Gray with time delay set at 15 minutes.
3. Ceiling Mounted Ultrasonic Occupancy Sensing Switches:
Watt Stopper type WT-Series 1100, 2200, 2250 – White with time delay set at 15 minutes with a Watt Stopper UNV power pack. Mount power pack above accessible ceiling. Provide all necessary wiring between power pack and occupancy sensor.
4. Ceiling/Wall Mounted Line Voltage Dual Technology Occupancy Sensing Switches:
Watt Stopper type DT-200 – White with time delay set at 15 minutes with a Watt Stopper UNV power pack. Mount power pack above the accessible ceiling or in wall behind sensor. Provide all necessary wiring between power pack and occupancy sensor.
5. Wall Mounted Line Voltage Digital Time Switches:
Watt Stopper type TS-400-G-120/277-Gray with adjustments set as directed by the Owner.

- C. All receptacles shall be side and back wired, self-grounding of the type indicated on the drawings, or as follows. Catalog numbers shown below are Pass & Seymour specification grade unless otherwise indicated. Equal devices manufactured by Hubbell or Leviton shall be acceptable.

1. Duplex Convenience Receptacles 20A-125V (Grounding Type)	CRB5362 Series - Gray
2. Weatherproof Duplex Receptacles 20A-125V (Grounding Type)	CRB5362-WP Series - Gray with Weatherproof Plate
3. Duplex GFI Receptacle 20A-125V	2095 Series – Gray
4. Weatherproof Duplex GFI Receptacle 20A-125V	2097TRWR - Gray with Weatherproof Plate

5.8 Plates.

- A. Furnish and install wall plates for all wiring devices. Oversize plates are not acceptable. Where switches and/or receptacles are shown adjacent to each other, provide a common cover plate for each group of devices.

1. Plates shall be Pass & Seymour Type 302 stainless steel.
2. (or) Plates shall be Pass & Seymour "RP" Series high impact thermoplastic, and shall be gray in color.
3. Weatherproof switch plates shall be Crouse Hinds DS185 type.

4. Weatherproof receptacle plates shall be Crouse Hinds WLRD1 type.
- 5.9 "In-Use" Weatherproof plates shall be Intermatic WP5000 Series. Provide necessary number of gangs, mounting bases, inserts and gaskets.

6. MOTOR CONTROLLERS

6.1 SAFETY SWITCHES

- A. Furnish and install heavy duty type safety switches having the electrical characteristics, ratings and modifications shown on the drawings. All switches shall have:
 1. NEMA 1 general purpose enclosures unless otherwise noted for all interior applications;
 2. NEMA 3R rainproof enclosures unless otherwise noted for all exterior applications;
 3. Handle that is padlockable in "OFF" position;
 4. Non-teasible, positive quick-make, quick-break mechanism;
 5. UL approved and shall bear the UL label;
 6. All fusible switches shall have Class R fuse rejection clips.

6.2 MOTOR STARTERS

- A. Provide magnetic starters for three phase motors. Motor starters shall be full voltage non-reversing across the line magnetic type rated in accordance with NEMA standard sizes and horsepower ratings. Minimum size magnetic starter shall not be less than NEMA size one.
- B. Motor starters shall be furnished with the following additional equipment:
 1. In each magnetic starter provide cover mounted hand-off-auto selector switch complete with a manual overload reset button and a red "On" pilot light. Provide a control transformer with a secondary voltage of 120V, complete with primary overload and short circuit protection.
 2. Starters shall be suitable for the addition of at least three normally open and three normally closed auxiliary contacts. Provide a minimum of two normally open and two normally closed contacts unless additional contacts are scheduled on the drawings or required for proper control of the equipment.
 3. Overload relays shall be an integral part of the motor starter. Overload relays shall have a minimum ± 10 percent adjustment from the nominal heater rating. Heaters shall be available such that when used with the ± 10 percent adjustment, a continuous selection of motor full load currents can be obtained through the size limitations of the starter. Overload relays shall be manual reset and field convertible from manual to automatic reset. Overload relays shall be melting alloy or bimetallic type. Thermal units shall be of one-piece construction and interchangeable. The starter unit shall be inoperative if the thermal unit is removed. Provide 3 overload relays, one for each phase of the three-phase starter.
 4. Time delay relays with time delay after energization shall be provided for starters indicated, or as required for proper control of equipment. Time delay feature shall be adjustable from 0 to 60 seconds and set as indicated on the drawings.

6.3 MANUAL MOTOR STARTERS

- A. Thermal element type manual motor starters complete with melting alloy type thermal overload relays for single phase motors shall be Square D Class 2510. Provide overload relays sized in accordance with NEC requirements for the motor loads served.
- B. Provide flush mounted units in finished areas and surface mounted units in unfinished areas. Starter shall have NEMA I general purpose enclosure, unless otherwise indicated, and be rated for the motor horsepower required.

6.4 FUSES

- A. Fuses shall be furnished and installed in each fused switch, and shall have ratings as shown on the drawings. Provide fuses in accordance with recommendations of manufacturers whose equipment is being protected.
- B. Three spare fuses shall be furnished for each size and type used. Each fused switch shall be provided with a mastic backed label clearly identifying the type and size of fuse required.

7. MANUFACTURERS

- 7.1 Panelboards, safety switches, and motor controllers manufactured by Square D, Cutler Hammer, Siemens, or General Electric are acceptable. All major components shall be of the same manufacturer.

8. LIGHTING

- 8.1 Manufacturers: Firms regularly engaged in the manufacture of interior and exterior light fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than three years. Manufacturers of lighting fixtures are noted on the drawings by the light fixture schedule and/or by notes.
- 8.2 Substitutions: If the Contractor proposes to substitute lighting fixtures for those shown on the drawings or specified herein, he shall submit a list of proposed fixtures together with technical data to substantiate that the substitute fixtures are equivalent in all respects to the specified equipment. Proposed substitute fixtures must be submitted to the architect/engineer for review a minimum of ten (10) days prior to the project bid date. Only original documentation will be accepted for review. After review of the proposed substitute fixtures, an addendum or bid bulletin will be issued to include acceptable equipment. The review of substitute equipment in no way relieves the contractor of the responsibility to provide equipment that is equivalent in all respects to specified fixtures. Lighting fixtures as shown on the drawings or specified herein shall be used as a basis and standard of comparison in the review and consideration of fixtures of other manufacturers. The Architect/Engineer shall have the final authority as to whether the fixture is equivalent to the specified item. The proposed substitution may be rejected for the aesthetic value if felt necessary or desirable. In the event the proposed substitutions are rejected, the Contractor shall furnish the specified item.
- 8.3 Install all light fixtures at locations and heights as indicated on the drawings, in accordance with fixture manufacturer's written instructions, applicable requirements of the NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that the light fixtures fulfill all necessary requirements.
- 8.4 All lighting fixtures and their electrical components shall bear the UL label.

8.5 Lighting fixture supports: Properly support and install fixtures in strict accordance with all applicable building codes and standards. Fully and completely coordinate the installation of fixtures with actual ceiling systems, and with all building trades. In general, provide fixture supports according to the following (unless applicable codes require more restrictive support details):

- A. All lighting fixtures installed in grid type suspended ceiling systems, shall be positively attached to the ceiling system with clips that are UL listed for the application. In addition, a minimum of four (4) ceiling support system rods or wires shall be provided for each light fixture and shall be installed not more than six (6) inches from fixture corners. Provide two (2) No. 12 gage hangers from each fixture housing to the building structure above (wires may be installed slack). Light fixtures that weigh more than 56 pounds shall be supported directly from the structure above by UL listed and approved hangers. Light fixtures that are smaller than the ceiling grid shall be installed at locations indicated on the reflected ceiling plans, or shall be installed in the center of the ceiling panel and shall be supported independently by at least two metal channels that span and are secured to the ceiling system.
- B. Suspended lighting fixtures shall be supported directly from the building structure without using suspended ceilings as support systems. Support systems shall be UL listed and approved for the specific installation. Where pendants or rods exceed 48 inches in length, brace support systems to limit swinging.

8.6 LED DRIVERS

- A. Driver shall operate from 60 Hz input source of 120V through 277V with sustained variations of +/- 10 percent (voltage and frequency).
- B. Driver input current shall have Total Harmonic Distortion (THD) of less than 20 percent when operated at nominal line voltage.
- C. Driver shall have a Power Factor greater than 0.90.
- D. Driver shall avoid interference with infrared devices and eliminate visible flicker.
- E. Driver shall comply with ANSI C62.41 Category A for Transient protection.
- F. Driver shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
- G. The luminaire shall be capable of continuous dimming over a range of 100% to 5% of rated lumen output. Dimming shall be controlled by a 0-10VDC signal.
- H. Control device must be compatible with type of driver, and coordinated prior to submission of shop drawings.
- I. If driver is remote-mounted, provide maximum allowable distances for secondary wire runs to luminaires.
- J. Provide with mounting hardware as required.

8.7 LEDS

- A. Color temperature specified shall be uniform for all LED modules within like luminaire types. Color temperature measurement shall have a maximum 2 SDCM on the MacAdam Ellipse.
 - B. Correlated color temperature of 3500K unless otherwise specified. Minimum color rendering index (CRI) of 85.
 - C. LED light output and efficacy shall be measured in accordance with IES LM-79 standards.
 - D. LED life and lumen maintenance shall be measured in accordance with IES LM-80 standards.
 - E. Rated minimum life of 50,000 hours.
 - F. The individual LED's shall be connected such that a catastrophic loss or the failure of one LED will not result in a light output loss of the entire luminaire.
- 8.8 Standard plaster frames shall be provided for all recessed lighting fixtures installed in plaster or drywall finished walls or ceilings. Coordinate with architectural drawings.
- 8.9 Coordinate with other electrical work as appropriate to properly interface installation of lighting fixtures with other work.
- 8.10 Clean lighting fixtures of dirt and debris upon completion of the installation. Protect installed fixtures from damage during the remainder of the construction period.
- 8.11 Upon completion of the installation of lighting fixtures, and after building circuits have been energized, apply electrical energy to demonstrate capability and compliance with the requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- 8.12 Undercabinet and undercounter light fixtures shall be installed with 3/8" deep x 2" x 4" wood spacers painted black to provide an air space between fixture and top of millwork.

9. EXECUTION

9.1 INSTALLATION METHODS

- A. Conductors shall be installed in concealed raceways except as shown/noted otherwise on the drawings or in the specification. Exposed conduits and wires shall be installed parallel or perpendicular to all building surfaces. Conduits and wires in the space above ceilings shall be supported adequately and shall not be laid on the top of ceiling systems. All conduits and wires installed above ceilings shall be considered exposed.
- B. The lighting and power branch circuit conductors shall be installed in separate raceway systems unless specifically shown or noted otherwise.

- C. Conduits, except those located within floor construction, shall be run parallel with or perpendicular to lines of the building unless otherwise noted on the drawing. Electrical conduits shall not be hung on hangers with any other service foreign to the electrical systems, unless specifically approved by the Engineer. Electrical conduits shall be hung above all other service pipes. Hangers on different service lines running close to and parallel with each other shall be in line with each other and parallel with, or perpendicular to, the lines of the building. Exact location of electric outlets, piping, ducts, and the like shall be coordinated to avoid interferences between lighting fixtures, piping, ducts, and similar items.
- D. Outlet Box Locations. Outlet boxes shall be located so they are not placed back-to-back in the same wall, and in metal stud walls, are separated by at least one stud space in order to limit sound transmission from room to room. Outlet boxes installed on opposite sides of fire rated walls shall be spaced at least 24" apart.

9.2 EXISTING UTILITIES

- A. Existing utilities within the contract limits shall be rerouted and/or abandoned as shown on the drawings. The Contractor shall verify the location of all existing utilities with the Owner and Utility Companies prior to commencing excavation work. All new or rerouted work must be in place before removal of existing work. All service outages must be scheduled with the Owner and be approved by the Owner. The drawings and survey data of the contract documents indicate the available information on the existing power and communication services, and on new services to be provided to the project by local utility companies. Accuracy of this information is not assured.

9.3 ELECTRICAL-MECHANICAL EXTENT OF WORK

- A. The responsibility of work specified under Divisions 21,22,23 and 26 is clarified under Sections 21 05 00, 22 05 00 and 23 05 00.

9.4 CUTTING AND PATCHING

- A. The Electrical Contractor shall be responsible for all cutting and patching of holes in the building construction which are required for the electrical work. Cutting, patching and painting shall conform to the requirements of the Division 1 and, if applicable, Division 2 of these specifications.
- B. Cutting of structural framing, walls, floors, decks and other members intended to withstand stress is not permitted.
- C. Use care in piercing water proofing. After the part piercing the waterproofing has been set in place, seal openings, and make absolutely watertight.
- D. All patching shall be finished and painted to match the surface around it.

9.5 PAINTING, FINISHING

- A. Painting of electrical work exposed in occupied spaces, except mechanical and electrical machine rooms and maintenance/service spaces; and work exposed on the exterior of the facility is specified and performed under other divisions of these specifications.

- B. Factory finishes, shop priming, and special protective coatings are specified in the individual equipment specification sections.
- C. Where factory finishes are provided on equipment and no additional field painting is specified, all marred or damaged surfaces shall be touched up or refinished so as to leave a smooth, uniform finish at the time of final inspection.

9.6 ACCESS PANELS

- A. Furnish and install panels for access to junction boxes and similar items where no other means of access, such as a readily removable, sectional ceiling is shown or specified.
- B. Panels shall not be less than 12-inches by 16-inches in size. Larger panels shall be furnished where required. Panels in tile or other similar patterned ceilings shall have dimensions corresponding to the tile or pattern module.

9.7 INSTALLATION OF EQUIPMENT

- A. Install and connect all appliances and equipment as specified and indicated for this project, in accordance with the manufacturers' instructions and recommendations. Furnish and install complete electric connections and devices as recommended by the manufacturer or required for proper operation.

9.8 WORK IN EXISTING BUILDING

- A. Where drawings indicate work to be done in the existing building, the Contractor shall carefully examine such areas to determine the nature and extent of work involved before submitting his bid. The Contractor shall be responsible for all damage to existing items and utilities due to the progress of his work, and shall repair all such items or replace same to an approved condition at his own expense.

9.9 PROTECTION

- A. Protection of existing equipment and facilities shall be provided and coordinated with the Owner.

9.10 OUTAGES

- A. All outages shall be scheduled and approved by the Owner. Contractor shall submit in writing a document indicating the times of day and duration of all electrical outages.

9.11 ELECTRICAL DEMOLITION

- A. All existing devices shown with cross-hatching and/or so noted shall be removed, relocated, remain or shall be abandoned as noted on the drawings.
 - 1. Devices shall be completely removed from walls that are also shown to be removed. Devices shown to be removed on drywall or plaster type walls that are to remain shall have the wall surface patched to match the existing. Flush type devices shown to be removed on concrete or brick type walls that are to remain shall have the device removed and shall be provided with a blank cover plate.

2. Conduits shall be completely removed from walls that are also shown to be removed. Conduits may be abandoned in walls that are to remain. All conduits and boxes that are surface mounted and no longer require active circuits shall be removed.
3. See the Architectural Drawings for wall removal and types.
4. For conductors serving devices shown to be removed, disconnect the device and remove all conduit and conductors back to the panel or to the next device shown to remain or as required by actual existing circuiting. Continuity of circuiting shall be maintained for the existing devices shown to remain. Circuiting shall be extended from new or existing circuits as shown or as required.
5. For mechanical equipment indicated shown to be removed on either the mechanical and/or the electrical plans, disconnect the equipment and remove all conduit, conductors and associated electrical supply equipment. Remove conduit and conductors back to the panel or the next device shown to remain or as required by actual circuiting.
6. Coordinate all phasing and related electrical system outages with the Owner and all other disciplines.

- B. Existing Material: Refer to the Supplementary Conditions Section of this specification for the disposition of all salvageable material.

9.12 COORDINATION

- A. Coordinate the electrical work with work of the different trades so that:
 1. Interferences between mechanical, electrical, architectural, and structural work, including existing services, is avoided.
 2. Within the limits indicated on the drawings, the maximum practicable space for operation, repair, removal and testing of electrical, and other equipment will be provided.
 3. Pipe, conduits, ducts, and similar items, shall be kept as close as possible to ceilings, walls, columns, to take up a minimum amount of space. Pipes, conduits, ducts, and similar items shall be located so that they will not interfere with the intended use of other equipment.
 4. Furnish and install, without additional expense to the Owner, all offsets, fittings and similar items necessary in order to accomplish the requirements of coordination.

9.13 SLEEVES

- A. Sleeves shall be used to accommodate conduit or tubing where conduit or tubing passes through concrete walls or slabs.
- B. All sleeves through floors and walls shall be black iron pipe, flush with finished faces of walls, ceilings or floors; and shall be sized to accommodate the raceways indicated. Sleeves through outside walls above grade shall be caulked with approved caulking compound. Sleeves shall not be required through on-grade slabs.
- C. For raceways which enter buildings below grade, install manufactured floor and thru-wall seals, similar to Type "FSK" or "WSK" as manufactured by O.Z. Electric Manufacturing Company.

9.14 CABLE AND CONDUIT SEALS

- A. Seals shall be provided around all conduits and cables which penetrate smoke walls, fire walls, and floors. Nelson Flameseal system shall be used to seal penetrations of electrical cables and conduits.

- B. Materials used shall be flameseal putty, ceramic fiber insulation and where rigid support on large oversized openings is required, ceramic fiber board. Board shall be rigid and able to withstand temperatures in excess of 2000 degrees F. Accessory hardware shall be required on oversized openings.
- C. Follow manufacturer's instructions in selecting the type of seals and accessories. Also follow the manufacturer's instructions on installation of the cable and conduit seals. Equal quality equipment by OZ Gedney and 3M shall be acceptable.

9.15 WIRING - NUMBER OF WIRES REQUIRED

- A. The number of wires for lighting and receptacle branch circuits is not shown on the drawings. The number of wires in any circuit shall be determined in accordance with the National Electrical Code, and wiring shall be provided to perform all functions of the devices being installed. Additionally, wires shall be provided as required by the contract documents, i.e. equipment grounds, etc. Provide the number of wires required for a complete and workable system.

9.16 Furnish and install outlet boxes, pull boxes, and conduit fittings as described below. Catalog numbers shown are Appleton Electric Company. Equal materials by Steel City, O.Z., Gedney and Raco are acceptable.

9.17 OUTLET BOXES

A.	Lighting Boxes (concealed)	No. 40-3/4
B.	Lighting Boxes (concrete)	OCR Series
C.	Lighting Boxes (exposed)	4S-3/4 or 40-3/4
D.	Flush Switches, Receptacles and Flush Junction Boxes	No. 4S-3/4 with separate extension plaster ring; M*-250 in masonry construction (* refers to number of devices in the box)
E.	Weatherproof type Switch and Receptacle Boxes (Exposed)neoprene gasket.	FS Series w/FS cover and
F.	Switch and Receptacle (exposed)	4S-3/4 with 8360 or 8370 series raised surface cover.

9.18 PULL BOXES

- A. Pull boxes shall be fabricated of code gauge galvanized sheet metal and shall be sized in accordance with National Electrical Code requirements, or as shown on the drawings. Provide removable cover on the largest access side of the box. In-line conduit pull boxes may be O.Z., Type PBW, or equal. Provide pull boxes at all code required locations, and as needed to aid in cable pulling.

9.19 MOUNTING HEIGHTS

- A. Mounting heights to the center of the box and above finished floor for the items listed below shall be as follows, unless otherwise shown. All other device mounting heights shall be as shown on the drawings. All devices shall be mounted in accordance with ADA (Americans with Disabilities Act) requirements.

1.	Flush tumbler switches and lighting controls	46"
2.	Switches in concrete block	46"
3.	Switches over wainscot	6" above 48" wainscot
4.	Convenience outlets	18" mounted vertically with ground prong slot at bottom
5.	Safety switches	54"
6.	Motor controllers	54"
7.	Receptacles above counters	6" above counters mounted vertically
8.	Convenience outlets in mechanical, electrical, telecommunications, janitor, and elevator machine rooms	48"
9.	Exterior W.P. convenience outlets	24" above grade mounted (horizontally) (vertically)
10.	Fire alarm pull station	46"
11.	Fire alarm horn, speaker, bell, chime and/or strobe	84"

- B. Contractor shall check all equipment layouts and verify exact mounting heights.

9.20 NAMEPLATES

- A. Nameplates shall be provided for all items such as panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards and motor control centers, control devices and other significant equipment.
- B. Nameplates shall be 1" x 2-1/2" laminated black phenolic resin with a white core with engraved lettering, a minimum of 3/16-inch high. Manufacturers factory installed nameplates shall be acceptable provided all information is furnished.
- C. Nameplates shall identify the equipment item that the device is serving and also from where the device is being fed from. Nameplates shall also identify the system voltage of the item of equipment.

10. CLOSE OUT AND OPERATION INSTRUCTIONS

- 10.1 Sequence operations properly so that all work of this project will not be damaged or endangered. Operate each item of equipment and each system in a test run of appropriate duration to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance.

- 10.2 Conduct a full-day walk-through instruction seminar for the Owner's personnel to be involved in the continued operation and maintenance of electrical equipment and systems. Explain the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, security, safety, efficiency and similar features of the systems.
- 10.3 At the time of substantial project completion, turn over the prime responsibility for operation of the electrical equipment and systems to the Owner's operating personnel. Until the time of final acceptance, provide full time operating personnel, who are completely familiar with the work, to consult with and continue training the Owner's personnel.
- 10.4 AS-BUILT DRAWINGS
 - A. Contractor shall provide the Owner with as-built drawings for all electrical systems as described in these specifications and/or shown on the Drawings. This shall consist of all drawings, wiring schematics, and diagrams for the fire alarm, telecommunications systems, as well as, any change to the systems shown on the drawings.

END OF SECTION 26 00 00

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work shall include all labor, materials, and equipment necessary to completely remove, disconnect and protect the site features as indicated on the plans and as herein specified.
- B. This section includes the following:
 - 1. Protecting existing vegetation to remain.
 - 2. Removing existing vegetation.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above- and below-grade site improvements.
 - 6. Disconnecting, capping or sealing, removing site utilities, and abandoning site utilities in place.
- C. Related Sections:
 - 1. Division 01 Section "Construction Facilities and Temporary Controls" for temporary utility services, construction and support facilities, security and protection facilities if included.
 - 2. Division 02 Section "Selective Demolition" for demolition of buildings, structures, and site improvements.

1.3 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.
 - 1. Reference drawings for salvage items.

1.4 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated
- D. Utility Locator Service: Notify One Call for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
- F. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Erection of sheds or structures.
 - 4. Impoundment of water.
 - 5. Excavation or other digging unless otherwise indicated.
 - 6. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Earthmoving section.
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain on site
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site by temp chain link or snow fence.
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Repair or replacement of trees scheduled to remain and damaged by construction operations shall be at Contractor's expense. Cost for tree replacement shall be determined in accordance with the Tree Evaluation Methods as described in The Guide for Plant Appraisal, 1992 Edition by the Council of Tree and Landscape Appraiser

3.3 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Locate, identify, and disconnect utilities indicated to be abandoned in place.
 - 1. Do not proceed with utility interruptions without Owner's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 3. Use only hand methods for grubbing within protection zones.
 - 4. Chip removed tree branches and stockpile in areas approved by Architect for use on project site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth indicated in geotechnical report in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Do not stockpile topsoil within protection zones.
 - 2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity to be reused.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 10 00

SECTION 31 20 00 - EARTH MOVING

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. Preparing subgrades for slabs-on-grade, walks, and pavements.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subsurface drainage backfill for walls and trenches.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.
6. Fine Grading and redistribution of topsoil

- B. Related Sections:

1. Section 01 50 00 "Construction Facilities and Temporary Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

- B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

- D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

- E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

- F. Fill: Soil materials used to raise existing grades.
- G. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 1. Controlled low-strength material, including design mixture.
 2. Warning tapes.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each soil material proposed for fill and backfill as follows:
 1. Classification according to ASTM D 2487.
 2. Laboratory compaction curve according to ASTM D 698.
 3. Top Soil Analysis according to ASTM D 442

1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
- B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
- C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures are in place.

- D. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
 2. Parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- E. Do not direct vehicle or equipment exhaust towards protection zones.
- F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP and SM according to ASTM D2487 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- L. Turf Area Topsoil: New topsoil that is fertile, friable, natural loam, dark in color, free of subsoil, clay lumps, brush, weeds, and other debris; and free of roots, stumps, stones larger than 1/2 inch in any dimension; and free of other extraneous or toxic matter harmful to plant growth. Topsoil should be obtained from local sources. It should have an acidity range (pH) of 5.5 - 7.5, and an organic matter content between 2 and 8 percent. Loam topsoil must have 7 to 30 percent clay, 28 to 60 percent silt, and less than 52 percent sand particles. Not more than 10 percent of topsoil weight can be gravel or stones.
- M. Planting Bed Topsoil: New topsoil that is fertile, friable, natural loam, dark in color, free of subsoil, clay lumps, brush, weeds, and other debris; and free of roots, stumps, stones larger than one inch in any dimension; and free of other extraneous or toxic matter harmful to plant growth. Topsoil should be obtained from local sources. It should have an acidity range (pH) of 5.5 - 7.5, and an organic matter content between 2 and 8 percent. Loam topsoil must have 7 to 30 percent clay, 28 to 60 percent silt, and less than 52 percent sand particles. Not more than 10 percent of topsoil weight can be gravel or stones.
 - 1. Particle Size: Provide topsoil which conforms with the following categories:
 - a. Clay: 0.002 mm and smaller.
 - b. Silt: 0.002 to 0.02 mm.
 - c. Sand: 0.02 to 0.2 mm.
 - 2. Proposed topsoil material shall be inspected and approved by the Architect.

2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - d. 6 inches beneath bottom of concrete slabs-on-grade.
 - e. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.4 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: As indicated.

- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

- D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

- E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3.7 SUBGRADE INSPECTION

- A. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.

- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete"
- D. Backfill voids with satisfactory soil while removing shoring and bracing.
- E. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under concrete pavement, scarify and recompact top 9 inches of existing subgrade and each layer of back fill or fill soil material at 98 percent.
 - 3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent.
 - 4. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 5. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBSURFACE DRAINAGE

- 1. Compact each filter material layer to 95 percent of maximum dry unit weight according to ASTM D 698.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
 - 2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase course to required crown elevations and cross-slope grades.
 - 4. Place subbase course 6 inches or less in compacted thickness in a single layer.
 - 5. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 6. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.18 FINE GRADING / TOP SOIL PLACEMENT

- A. Prior to fine grading, loosen subgrade soil to a depth of 6".
- B. Cut and fill all areas to elevations and tolerances specified. Leave graded surface clean, free from rubbish and large clods and reasonably smooth. Topsoil shall only be placed during dry weather and when the existing soils are unfrozen.
- C. Remove roots, weeds, rocks over 1", and any foreign material while spreading.
- D. Grade surfaces accurately to elevations indicated on plan to within a tolerance of ½ inch when measured with a 10 foot straightedge and to assure areas drain away from structures and to prevent ponding and pockets. Provide subgrade surfaces free of stones 4 inches in greatest dimension.
 - 1. Provide ½" edge against sidewalks to allow sod to sit flush with pavement edge.
- E. After placement, loosen topsoil by cultivation to a minimum depth of 6 inches throughout entire site. Utilize a Blecavator cultivator, or similar equipment to separate rocks from the soil during the cultivation process, and directing the pulverize soil to the top of the soil profile.
- F. Maintenance: Protect final graded areas from traffic and erosion. Keep free of trash and debris.

3.19 FIELD QUALITY CONTROL

- A. Special Inspections: Contractor will engage a qualified special inspector to perform the following special inspections:
 - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 - 2. Determine that fill material and maximum lift thickness comply with requirements.
 - 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

- B. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 31 22 19 – SITE GRADING

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work shall include all labor, materials, and equipment necessary to completely furnish and install the fine grading and soil preparation as indicated on the plans and as herein specified.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. See Section 31 20 00 “Earth Moving” for backfilling, subgrade preparation and rough grading.

1.3 ACTION SUBMITTALS

- A. Topsoil samples. Provide a quart bag sample and lab analysis for comparison to specification for both onsite topsoil and import material.
- B. Test Reports

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487.
 - 2. Laboratory compaction curve according to ASTM D 698.

1.5 QUALITY ASSURANCE

- A. Subcontract site grading work to a single firm specializing in fine grading operations. Firm shall have satisfactory record of performance on completed projects of comparable size and quality.
- B. Post-grading Conference: After completion of fine grading and topsoil placement, conduct a conference at Project site with Landscape Architect, UNL campus Landscape Architect, UNL Landscape Services and CM for acceptance of work by the owner.

1.6 JOB CONDITIONS

- A. Proceed with and complete fine grading as rapidly as portions of site become available, working within seasonal limitations.

- B. Protect existing utilities, paving, plant material, and other facilities from damage caused by fine grading operations.
- C. Perform fine grading work only after other work affecting ground surface has been completed.

2. PRODUCTS

- A. **Planting Bed Topsoil:** New topsoil that is fertile, friable, natural loam, dark in color, free of subsoil, clay lumps, brush, weeds, and other debris; and free of roots, stumps, stones larger than one inch in any dimension; and free of other extraneous or toxic matter harmful to plant growth. Topsoil should be obtained from local sources. It should have an acidity range (pH) of 5.5 – 8.0, and an organic matter content between 3 and 8 percent. Loam topsoil must have 7 to 35 percent clay, 28 to 60 percent silt, and less than 52 percent sand particles. Not more than 10 percent of topsoil weight can be gravel or stones.
 - 1. **Particle Size:** provide topsoil which conforms with the following categories:
 - a. Clay: 0.002 mm and smaller.
 - b. Silt: 0.002 to 0.02 mm.
 - c. Sand: 0.02 to 0.2 mm.
 - 2. Proposed topsoil material shall be inspected and approved by the Landscape Architect.
- B. **Turf Area Topsoil:** New topsoil that is fertile, friable, natural loam, dark in color, free of subsoil, clay lumps, brush, weeds, and other debris; and free of roots, stumps, stones larger than one inch in any dimension; and free of other extraneous or toxic matter harmful to plant growth. Topsoil should be obtained from local sources. It should have an acidity range (pH) of 5.5 – 8.0, and an organic matter content between 3 and 8 percent.

3. EXECUTION

3.1 INSPECTION

- A. Examine finish surfaces, grades, topsoil quality, and depth. Do not start site grading work until unsatisfactory conditions are corrected and approved by Landscape Architect.

3.2 FINE GRADING / TOP SOIL PLACEMENT

- A. Prior to fine grading, loosen subgrade soil to a depth of 6" min.
- B. Cut and fill all areas to elevations and tolerances specified. Leave graded surface clean, free from rubbish and large clods and reasonably smooth. Topsoil shall only be placed during dry weather and when the existing soils are unfrozen.
- C. Remove roots, weeds, rocks, and any foreign material while spreading.
- D. Grade surfaces accurately to elevations indicated on plan to within a tolerance of ½ inch when measured with a 10 foot straightedge and to assure areas drain away from structures and to prevent ponding and pockets. Provide subgrade surfaces free of stones 1 inches in greatest dimension.

1. Provide ½" edge against sidewalks to allow sod to sit flush with pavement edge.
2. Provide 3" edge against sidewalks in planting bed areas for mulch to sit flush with pavement edge.

E. Loosen topsoil by cultivation to a minimum depth of 6 inches throughout entire site. Utilize a Blecavator cultivator, or similar equipment to separate rocks from the soil during the cultivation process, and directing the pulverize soil to the top of the soil profile.

F. Maintenance: Protect final graded areas from traffic and erosion. Keep free of trash and debris.

3.3 CLEANUP AND PROTECTION

A. During fine grading operations, keep pavements clean and work area in an orderly condition.

3.4 FINAL INSPECTION

A. At completion of fine grading and topsoil placement acceptance of work is required by Landscape Architect prior to proceeding.

END OF SECTION 31 22 19

SECTION 32 13 13 - CONCRETE PAVING

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work shall include all labor, materials, and equipment necessary to completely furnish and install the Portland Cement Concrete Paving as indicated on the plans and as herein specified.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. See Section 03 30 01 "Cast-in-Place Concrete" for additional requirements.
 - 2. See Section 31 20 00 "Earth Moving" for backfilling and subgrade preparation.

1.3 SUBMITTALS

- A. Mockups: Cast a minimum 4-foot by 4-foot field panel of exterior concrete paving to demonstrate the specified coarse angular aggregate mix, chemical surface retarder application, and depth of exposure. Approved mockup will remain as the visual and textural standard for all skateboarding-deterrent pavement on the project.

2. PRODUCTS

2.1 CONCRETE MATERIALS

- A. Concrete construction materials including reinforcing, concrete and related materials are specified in Section 03 30 00 "Cast-In-Place Concrete."
- B. Coarse Aggregate: 100% crushed, angular stone conforming to ASTM C33, graded from minimum 3/8-inch to maximum 3/4-inch sizing. Rounded river gravel, pea gravel, or smooth glacial stone aggregates are prohibited.

2.2 PROPORTIONING AND DESIGN OF MIXES

- A. Design mixes to provide normal weight concrete with the following properties, unless otherwise indicated on drawings and schedules:
- B. Prepare design mix such that ratio of coarse aggregate to fine aggregate is as specified in section 2.3 subparagraph B. Section 03 30 00 "Cast In Place Concrete for 30% Limestone / 70% Sand and Gravel Aggregate."
 - 1. Parking lots, drives and walks shall have a 28 day F'c = 4000 psi.
- C. Use air-entraining admixture in all exterior concrete.

2.3 ADMIXTURES

- A. Top-Surface Chemical Retarder: Water-based, spray-applied liquid formulation engineered to delay the set of the top surface cement paste to achieve a uniform medium-to-heavy aggregate exposure depth.

2.4 SEALANTS

- A. Foam Expansion Joint Filler: Polyethylene closed-cell expansion-joint filler. Provide Sonoflex F by Sonneborn or equal.
- B. Joint Sealer: Polyurethane self-leveling sealant, ASTM C 920, Type S, Grade P, Class 25, Use T at all expansion and contraction joints.

3. EXECUTION

3.1 SUBBASE PREPARATION

- A. For subbase preparation see Section 31 00 00 "Earthwork."

3.2 CONCRETE

- A. For concrete placement, finishing, curing, surface repairs, and quality control testing during construction see Section 03 30 00 "Cast-In-Place Concrete."

3.3 JOINTS

- A. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- B. Expansion Joints: If spacing is not indicated, construct expansion joints at 40 foot maximum intervals and at points of contact between slabs and vertical surfaces such as columns, foundation walls, stoops and elsewhere as indicated.
 - 1. Provide foam expansion joint fillers and sealant or traffic grade hot pour at all expansion joints.
- C. Contraction (Control) Joints: Should be cut $\frac{1}{4}$ of the slab thickness.
 - 1. If joint spacing is not indicated, lay out joints to form square panels. When this is not practical, rectangular panels can be used if the long dimension is no more than 1.25 times the short side. In 4" slabs, the long side should not exceed 10 feet.
 - a. Spacing: Not to exceed 30 x slab thickness or 10 feet, whichever is less.

3.4 FINISH

- A. All sidewalk surfaces should have a textured, non-slip broom finish free from trowel marks, except for the edging tool.

- B. Exposed Aggregate Finish: Immediately following initial screeding and bull floating, apply chemical surface retarder uniformly across the slab in strict accordance with the manufacturer's written instructions. Within 24 hours of placement, wash away the retarded surface cement paste using pressurized water and stiff nylon brushes to expose the embedded angular aggregate. Achieve an exposure depth of 1/8-inch to 1/4-inch across the entire designated zone.

END OF SECTION 32 13 13

SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Expansion and contraction joints within cement concrete pavement.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type and color of joint sealant required.
- C. Product certificates, test reports.
- D. Compatibility and Adhesion Test Reports: From sealant manufacturer.

1.4 QUALITY ASSURANCE

- A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- B. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- C. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
 - 1. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Colors of Exposed Joint Sealants: As selected by Landscape Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
 - 1. Products:
 - a. Crafcro Inc.; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.

2.4 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.
- C. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- D. Install backer materials to support sealants during application and at position required to produce optimum sealant movement capability. Do not leave gaps between ends of backer

materials. Do not stretch, twist, puncture, or tear backer materials. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

- E. Install sealants at the same time backings are installed to completely fill recesses provided for each joint configuration and to produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
- G. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 32 13 73

SECTION 32 15 40 - CRUSHED DECOMPOSED GRANITE SURFACING

1. GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
 - 1. See Section 00 73 00 "Supplementary Conditions", if included, for requirements relating to interpretation of the drawings and specifications.

1.2 SUMMARY

- A. Work shall include all labor, materials, and equipment necessary to completely furnish and install the Crushed Decomposed Granite Surface (Aggregate Walking Surface) as indicated on the plans and as herein specified.
- B. This section includes the following:
 - 1. Crushed Decomposed Granite
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. See Section 31 "Earth Moving" for subgrade preparation.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Sieve Analysis
- B. Product Material:
 - 1. 1 qt bag of material

2. PRODUCTS

2.1 MATERIALS

- A. Aggregate Walking Surface:
 - 1. General:

- a. Crushed rock shall be decomposed granite and shall consist of clean, hard, tough and durable fragments (excluding schist, shale or slate) of uniform quality throughout and shall be free from thin, soft, or elongated pieces, disintegrated stone, dirt, organic or other deleterious material occurring free or as a coating on the rock.
2. Manufacture:
 - a. Hello Gravel
 - b. Or equal, if and as specifically approved by Architect by Addendum during bidding period.
 3. Color: Gray
 4. Gradation: The crushed rock surfacing shall be screened after crushing to remove excessive fines and shall be so graded as to meet the following requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8"	100
#4	85-100
#8	53-83
#16	33-53
#30	20-40
#50	16-28
#100	13-23
#200	12-20

5. Soundness: The fraction of crushed rock retained on the 1/2-inch sieve shall have a loss ratio of not less than 0.75 when subjected to 26 cycles of freezing and thawing in accordance to AASHTO Method T-103.
6. Abrasion: Crushed rock, when tested for abrasion by AASHTO Method T-96, Grade B, shall have a percentage of wear of not more than 45 percent.

2.2 SOIL SEPARATION BLANKET

- A. Spun or woven, non-degrading geotextile fabric that blocks 95% of weed growth and is permeable to air, water, gases and fertilizer.

2.3 EQUIPMENT

- A. The Contractor shall furnish adequate equipment necessary for the completion of the work.

3. EXECUTION

3.1 EXAMINATION

- A. Examine site and verify that conditions are suitable to receive work and that no defects or errors are present which would cause defective installation of product or cause latent defects in workmanship and function.
- B. Review subgrade to verify that it has been graded correctly and compacted as required for installation of the aggregate base.
- C. Before proceeding with work, Contractor shall notify the Landscape Architect and Owner in writing of any unsuitable conditions and conflicts.

3.2 LAYOUT

- A. Establish lines and levels; locate and lay out by instrumentation and similar appropriate means for aggregate paving finish grades.
- B. Staking: Provide a sufficient quantity of grade stakes as required to provide aggregate paving with smooth finish grades and positive drainage.

3.3 SUB-GRADE PREPARATION:

- A. Refer to Geotechnical report for subgrade preparation prior to placement of aggregate base. Grade subgrade with uniform slope between points where elevations are given.
- B. Grade subgrade surface to within 0.05 foot of finish grade minus paving thickness.
- C. Fill and compact any depressions and remove loose material to finish true to line and grade, presenting a smooth, compacted and unyielding surface.
- D. Remove debris, loose dirt and other extraneous materials.
- E. Ditches, drains and drain pipes shall be installed if necessary to protect of the pavement and base from cross flows of water. All water flow should be directed off of and away from base.

3.4 PLACEMENT AND COMPACTION

- A. Walking Path Surfacing:
 - 1. In general, walking paths constructed of crushed decomposed granite rock shall consist of a layer of crushed rock placed on a prepared subgrade to the width and cross section as provided by the plans.
 - 2. The crushed rock material shall be deposited uniformly upon an approved sub-grade in straight, single or double lines and compacted using sheepsfoot roller and water as required. The gravel surface course material shall then be delivered and uniformly spread, followed immediately by compaction using an approved roller and water as required, to the satisfaction of the Landscape Architect and Owner.
 - 3. The depths indicated in the details represent the depths after compaction.

4. Construct surfacing as a stabilized surface to meet ADA requirements.
5. Add stabilizer product to crushed decomposed granite.

3.5 **FIELD QUALITY CONTROL**

A. Density tests:

1. Perform tests in accordance with ASTM D 2950.
2. Perform tests after final compaction.
3. Perform at least three tests.

B. PROTECTION

1. Protect pavement surface against heavy construction equipment
 - a. Contractor is responsible for replacing damaged pavement, if damage was preventable, at his own expense.

END OF SECTION 32 15 40

SECTION 32 92 00 – TURF AND GRASSES

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY OF WORK

- A. Work shall include all labor, materials, and equipment necessary to completely furnish and install the Turf and Grasses as indicated on the plans and as herein specified.
- B. This section includes the following:
 - 1. Seeding
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling
 - 2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pesticides and Herbicides: Include product label and manufacturer's application instruction specific to this project.
- B. Certification of Grass Seed: From seed vender for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Included year of production and date of packaging.
 - 1. Certification of each seed mixture for turf grass sod and seed. Include identification of source, name and telephone number of supplier.
- C. **Seed Supplier to furnish tags that list job name, mix type and bag weight. Tags are to be attached to each bag by supplier. Bags are to be delivered to site with tags attached. As bags are used, tags shall be removed from each bag and collected by contractor. Contractor to turn over all used tags to Engineer**
- D. Qualification Data: For qualified landscape Installer.

- E. Material Test Reports: For existing native surface topsoil, existing in-place surface soil and imported or manufactured topsoil.
- F. Product Certificates: For fertilizers from manufacturer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association
 - 2. Experience: Five (5) years' experience in turf installation
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project Site when work is in progress
 - 4. Pesticide Applicator: State licensed, commercial.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened container showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Seed Supplier to furnish tags that list job name, mix type and bag weight. Tags are to be attached to each bag by supplier. Bags are to be delivered to site with tags attached. As bags are used, tags shall be removed from each bag and collected by contractor. Contractor to turn over all used tags to Engineer

Bulk Materials:

- 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
- 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge or soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
- 3. Accompany each delivery of bulk fertilizer and soil amendments with appropriate certificates.

1.6 PROJECT CONDITIONS

- A. Proceed with and complete seeding work as rapidly as portions of site become available, working within seasonal limitations.
- B. Protect existing utilities, paving, plant material, and other facilities from damage caused by seeding operations.
- C. Perform seeding work only after planting and other work affecting ground surface has been completed.

- D. Restrict pedestrian, bicycle, vehicular and other traffic from lawn areas until grass is established. Erect signs and barriers as required.
- E. Provide hose and lawn watering equipment as required.
- F. Planting Restrictions: Plant during on of the following periods.
 - 1. Cool Season Grass Seeding
 - a. Spring Planting: March 15 – April 15
 - b. Fall Planting: August 15- September 21 (preferred)
 - c. Dormant Planting: November 30- March 1
 - 2. Warm Season Grasses and Wildflower Seeding
 - a. Spring Planting: April 15 - June 1 (preferred)
 - b. Summer Planting June 15-Aug 15
 - c. Dormant Planting: November 30- March 1
 - 3. Weather Limitations: The actual planting shall be performed during those times in this season which are normal for such work as determined by weather conditions, and accepted practice in the locality. No work shall be performed when the ground is frozen, wet or otherwise un-tillable or when even distribution of materials cannot be obtained.

1.7 TURF AND GRASS ESTABLISHMENT

- A. The contractor will be responsible for turf and grass establishment as outlined in paragraph 3.

1.8 MAINTENANCE SERVICE

- A. The **Owner** will provide full maintenance (mowing, watering and weeding) post acceptance of established turf as defined by paragraph 3.7 Satisfactory Turf.

2. PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry and new crop complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances. Provide seed mixture composed of grass species, proportions and minimum percentages of purity and germination. Noxious weed seed free.
- B. Seed Mixture types: As noted on drawings.

2.2 FERTILIZERS

- A. Starter Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 15-25 percent nitrogen, 20-25 percent phosphorous, and 5-10 percent potassium, by weight.
 2. Application: Apply at rate of 1.0-1.5 lb. P₂O₂/1000 sf depending on recommendations of soil reports from a qualified soil-testing laboratory.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight
 2. Application: Apply at rated recommended in soil report from a qualified soil-testing laboratory.

2.3 MULCHES

- A. Hay or Straw Mulch: Provide air-dry, clean, mildew free, noxious weed seed free, native prairie hay, native grass hay, threshed oats, wheat, or rye.

2.4 PESTICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.5 WATER

- A. Water: Free of substance harmful to seed growth. Hoses or other methods of transportation furnished by Contractor.

3. EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AND GRASSES AREA PREPARATION

A. Limit turf and grasses subgrade preparation to areas to be seeded or sodded.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of **8 inches**. Remove stones larger than 1-inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least **8 inches**. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches of soil.
3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Sod areas are to be held down **½" below finished grade** when adjacent to pavement or seeded areas to create flush transition. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

- F. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

- A. Sow seed with acceptable seeding equipment. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 1. Seed drills, hydraulic seeders, and gravity broadcast seeders may be used as acceptable seeding equipment for planting seed. The contract may indicate the type of seeding equipment to be used on the project.
 - a. Seed Drills: Seed drills shall be equipped with press wheels or drag chains. The seed delivery system shall space rows no greater than 8 inches apart, shall include a seed box agitation system, and shall be capable of metering seed at the rate specified in the contract. Seed shall not be planted greater than 1/2 inch deep.
 - b. Hydraulic Seeders: Use hydraulic seeding equipment with a pump rated at no less than 100 gallons (350 L) per minute. The equipment shall have suitable working pressure and a nozzle adapted for hydraulic seeding. The supply and/or storage tanks shall have a means of mechanical agitation. The tanks shall be calibrated, and have a means of measuring the volume used or remaining in the tank. When using a hydraulic seeder, the fertilizer shall be applied separately from the seed.
 - c. Gravity Broadcast Seeders: In areas inaccessible to field machinery, implement mounted or handheld broadcast seeders may be permitted at the discretion of the Engineer. Gravity broadcast seeders shall provide agitation of the seed, have a functioning adjustable gate opening, and uniformly distribute seed on the seedbed. Implement mounted broadcast seeders shall be equipped with seed hopper baffle plates. Implement mounted broadcast seeders shall be equipped with a shielded front to prevent the spreading of material in front of the spreader.
 - 2. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate as noted on drawings
- C. Sow seed to a soil depth as recommended by supplier.
- D. Protect seeded areas with slopes where indicated by drawings or specifications; installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where indicated by drawings or specifications; install and anchor according to manufacturer's written instructions.
- F. Protect all other seeded areas not indicated to receive erosion control matting or blankets by spreading straw or hay mulch.
 - 1. Hay shall be either dry cured native prairie hay, native grass hay from seed growing operations, native grass hay from planted warm season grass stands

- a. Brome hay is not allowed
 - b. The mulch shall be certified as "Noxious Weed Free" by the "County Weed Control Authority" or other authorized agents
 - c. Hay shall be applied at the rate of 2 tons/acre
- 2. Straw shall be from threshed oats, wheat, or rye. Rye straw shall not be used in any wheat growing area. The straw shall be baled before the seasonal growth of annual weeds.
 - a. Straw shall be applied at the rate of 2.25 tons/acre
- 3. Hay or straw in a stage of decomposition so advanced as to "powder" in the mulch blower shall be rejected.
- 4. The mulch shall be applied loose enough to allow sunlight to penetrate and air to slowly circulate, but thick enough to partially shade the ground, reduce water evaporation, and reduce wind and water erosion.
- 5. Immediately after applying the mulch, the Contractor shall anchor it to the soil using a mulch crimper with approximately 6-inch cleats or other approved equipment with perpendicular, dull, disc blades.
 - a. All mulch shall be crimped the same day it is applied.
 - b. The crimper shall be narrow enough or hinged to uniformly crimp the mulch into the sloped and swale areas. More than one crimping may be necessary in these areas if directed by the Engineer.

3.5 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.6 TURF ESTABLISHMENT

- A. Establish turf by fertilizing, weeding, watering, replanting, and performing other operations as required to establish healthy, viable turf as defined by **Satisfactory Turf and Grass**. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
 - 4. Provide supplemental irrigation as need to germinate and establish turf prior to satisfactory turf acceptance

3.7 SATISFACTORY TURF AND GRASS

- A. **Turf installation and establishment shall meet the following criteria. Architect / Owner to review for acceptance prior to turnover for Supplemental Maintenance Service.**
1. Satisfactory Seeded Turf: At end of establishment period, a healthy, uniform, close stand of grass has been established, 90 percent weed free, and without surface grade irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 6 by 6 inches. Minimum of 2" in height.
 2. Satisfactory Sodded Turf: At end of establishment period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
 3. Satisfactory Seeded Warm Season Grass / Wildflowers: A healthy, uniform, stand of grass has been establishes and without surface grade irregularities, with coverage exceeding 60 percent over any 10 sq. ft. and bare spots not exceeding 12 by 12 inches. Minimum of 2" in height.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.8 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- C. Remove nondegradable erosion-control measures after grass establishment period and site has been stabilized.

END OF SECTION 32 92 00

APPENDIX 1

BRAUN INTERTEC

the science you build on

Limited Non-Destructive Hazardous Building Materials Survey Report

Chillicothe Readiness Center ACM Survey

1500 Washington Street
Chillicothe, Missouri

Prepared for

Clark & Enersen, Inc.

Prepared by

Braun Intertec Corporation

10011635_001

June 8, 2026



June 8, 2026

10011635_001

James Kendall AIA
Clark & Enersen, Inc.
1010 Lincoln Mall
Suite 200
Lincoln, NE 68508

Re: Limited Hazardous Building Materials Survey (Non-Destructive) Report
Chillicothe Readiness Center ACM Survey
1500 Washington Street
Chillicothe, Missouri

Dear Mr. Kendall:

The enclosed report provides the results of the limited non-destructive hazardous building materials survey conducted on April 30, 2026 at the above referenced site (Site). Braun Intertec Corporation (Braun Intertec) was authorized to conduct this survey in accordance with our Service Agreement made on January 28, 2026 and executed on April 22, 2026 between Braun Intertec and Clark & Enersen, Inc. (Clark & Enersen).

If you have any questions or need further assistance, please contact Bo Moreland at 913-647-5030 or email at bmoreland@braunintertec.com or David Ross at 785.383.2920 or email at dross@braunintertec.com.

Sincerely,

Braun Intertec Corporation



Warren "Bo" Moreland
Project Scientist



David Ross
Project Scientist



Sarah Anderson, CHMM
Associate Director, Principal Scientist

c: James Kendel, Clark & Enersen, Inc.



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1.0 Introduction

Braun Intertec Corporation (Braun Intertec) received authorization from Rick Wise of Clark & Enersen, Inc. (Clark & Enersen) to conduct a Limited Non-Destructive Hazardous Building Materials Survey of the Chillicothe Readiness Center located at 1500 Washington Street in Chillicothe, Missouri (Site), in accordance with the scope of services described in the service agreement between Braun Intertec and Clark & Enersen executed on April 22, 2026. The Limited Non-Destructive Hazardous Building Materials Survey was prepared in association with the limited renovation of the Site building.

2.0 Site Background

2.1 Site Description

The survey was conducted on April 30, 2026 by Bo Moreland of Braun Intertec. The subject of the survey and general construction information for the structure assessed on the property include:

Building Name – Building Address (Street, City, County, State)			
Building Use:	Readiness Center (Armory)	Occupancy Status:	Occupied
Number of Floors	Two stories with a basement	Estimate Building Square Footage:	34,248
Date of Construction:	1940		
Main Structure:	Monolithic concrete		
Interior Finishes:	Sheetrock and joint compound, plaster, lay-in ceiling panels and vinyl floor tiles, linoleum concrete flooring		
Exterior Finishes:	Concrete with block concrete and flat tar-shingle covered roof		

2.2 Previous Reports

The following previous inspection/survey/assessment report was reviewed as part of this survey:

Environmental Works, Inc. 2020. Hazardous Materials Survey, Missouri Army National Guard Facility
Readiness Center Gymnasium – 1500 Washington Street, Chillicothe, Livingston County, Missouri.
Prepared for The Clark Enersen Partners, November 25, 2020.

Results from the previous report identified the following to be <1% asbestos containing (does not meet the definition of asbestos-containing material [ACM] under US Environmental Protection Agency [EPA] National Emission Standard for Hazardous Air Pollutants [NESHAP], but regulated by Occupational Safety and Health Administration [OSHA]):



- The grey exterior door caulk was determined to be <1% chrysotile, is considered non-friable, and was observed in good condition.

3.0 Scope of Services

The scope of our services was limited to the following:

- Review of available documentation provided by current owner with regard to ACM, lead-based paint (LBP), polychlorinated biphenyls (PCBs), mercury, and other miscellaneous hazardous material. Existing sample data provided by current owner was utilized, where possible, to determine the presence or absence of ACM.
- Visually examined accessible areas and identified locations of suspect ACM.
- Collected and analyzed representative bulk samples of suspect ACM.
- Assigned a hazard rating based on asbestos content with respect to the materials condition, friability, accessibility, and hazard potential.
- Documented the current conditions and estimated ACM quantities of the suspect ACM based on visual observations.

3.1 Limitations

3.1.1 Limited Area – Non-Destructive Sampling

This survey was limited to the 750 square-foot area on the first floor as well as piping and ducting runs located in the basement that feed into the 750 square-foot area. A floor plan showing the areas of the survey is included in [Appendix A](#). In any building, the potential exists for hazardous building materials to be located inside walls, above ceilings, under floors, and other inaccessible areas. Due to building occupancy, destructive investigation was not performed during this hazardous building materials survey. Therefore, it was not feasible to inspect 100 percent of these areas. Also, the potential exists for hazardous materials to be found outside the building/buried underground. In the case of building demolition, a more thorough, destructive investigation must be performed in an attempt to identify hazardous building materials in areas that are currently inaccessible. Due to the above limitations, Braun Intertec cannot be held responsible for the presence of any such hidden materials.

The possibility exists for ACMs to be present in currently inaccessible chases, wall cavities, above hard ceilings, inside block walls and exterior foundations.

Various electrical systems were identified during the survey. These systems were believed to be currently “charged” and active. Suspect materials that may be located within these electrical boxes or control panels (breaker bars, insulation, and electrical wire insulation). For the purpose of this report, all electrical systems



in these areas assessed are to be assumed to contain asbestos until proven otherwise by sampling and analysis.

Concrete block walls and concrete foundations were noted at the time of the survey. It should be noted that vermiculite insulation may be present inside the concrete block and/or under concrete slab-on-grade floors.

To maintain the integrity of the roof systems, no roofing materials were sampled. For the purpose of this report, the roofing and flashing materials are assumed to contain asbestos until proven otherwise by sampling and analysis.

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

4.0 Methods and Procedures

4.1 Asbestos

Thirty-two bulk samples were collected on April 30, 2026, and submitted to EMSL Analytical, Inc., a microscopy laboratory that is fully accredited for bulk analysis.

The bulk samples were analyzed for asbestos using polarized light microscopy (PLM) and dispersion staining techniques utilizing the U.S. EPA-approved methodology 600/R-93/116 dated July 1993. This method estimates the amount of asbestos present and distinguishes between the following types of asbestos: chrysotile, amosite, crocidolite, tremolite, actinolite, and anthophyllite. The lower limit of detection for asbestos using this procedure is 1 percent asbestos by volume. Results are presented as estimates based on this method for the portions of the samples analyzed.

Based on the initial PLM results, select samples can be reanalyzed via PLM with quantification by the 400 Gravimetric Point Count (PC) method. Under current regulations, if the PLM results detect asbestos at a concentration of less than 10 percent in one or more of the samples from any sample unit, the owner or operator of the building may (1) elect to assume the amount to be greater than 1 percent and treat the material as ACM or (2) require verification of the amount by utilizing the PC Method. If the PC Method analysis determines that the concentration of asbestos is greater than 1 percent, the material will be determined to be regulated ACM. If the PC Method analysis determines that the concentration of asbestos is 1 percent or less, the material will be determined to be unregulated and non-asbestos containing.

The samples were analyzed under normal turnaround conditions. The attached results are based on analysis in accordance with currently accepted industrial hygiene practices at this time and location. Other than this, no guarantee is implied or intended.



5.0 Results

5.1 Asbestos-Containing Materials

No ACM was detected in the samples tested as part of this survey.

5.2 Non-Asbestos-Containing Materials

Suspect homogeneous materials identified and subsequently sampled for asbestos content during the survey that were found to contain no asbestos or contain 1 percent or less asbestos (non-ACM by regulatory definition) are listed in Table 1 and the laboratory analytical report and associated Chain of Custody provided in [Appendix B](#). Photographs of the materials sampled are included in a photographic log provided in [Appendix C](#).

6.0 Discussion

6.1 Asbestos

No ACM was detected in the samples tested as part of this survey. Reference should be made to Table 1 and the laboratory analytical report and associated Chain of Custody provided in [Appendix B](#) for specific details about the suspect building materials identified, sampled and determined to be non-ACM.

7.0 Inspector Certification

I, the undersigned, do hereby certify that I am an accredited Asbestos Inspector in the State of Missouri. A photocopy of my current asbestos inspector certificate is attached in [Appendix D](#).

Signature: _____ Date: June 8, 2026

Warren "Bo" Moreland

Project Scientist

Missouri Department of Natural Resources Asbestos Inspector Certification No: 7011091125MOIR23100

Tables

1. Asbestos Building Survey Results

Table 1
Asbestos Building Survey Results

Client: Clark & Enersen, Inc.
Location: 1500 Washington Street, Chillicothe, Missouri 64601
Date of Survey: April 30, 2026
Project: 10011635_001

Location		Suspect ACM Characteristics						
Homogeneous Area	Functional Space	Homogeneous Material Description	Ref. Client Sample No.	Asbestos Content (%) ¹	ACM Type ²	Category ³	Estimated Quantity (Units) ⁴	Material Condition ⁵
1st Floor	Breakroom	2-feet by 2-feet ceiling tile (white)	1-1 – 2-1	ND	--	--	760 Ft ²	G
1st Floor	Breakroom	Plaster with texture (white)	3-2 – 4-2	ND	--	--	310 Ft ²	G
1st Floor	Breakroom above ceiling	Insulation tape (gray)	5-3 – 6-3	ND	--	--	1 LF	G
1st Floor	Breakroom above ceiling	Wrap (black and yellow)	7-4 – 8-4	ND	--	--	30 LF	G
1st Floor	Breakroom	Cove base (gray) with mastic (yellow)	9-5 – 10-5	ND	--	--	50 LF	G
1st Floor	Breakroom	Floor seal caulk (white)	11-6 – 12-6	ND	--	--	10 LF	G
1st Floor	Breakroom	12-inch by 12-inch vinyl floor tile (gray) with mastic (yellow)	13-7 – 14-7	ND	--	--	760 Ft ²	G
1st Floor	Bathroom	1-foot by 1-foot ceramic floor tile (gray) with grout (brown)	15-8 – 18-9	ND	--	--	100 Ft ²	G
1st Floor	Breakroom air handling closet	1-foot by 1-foot vinyl floor tile (gray) with mastic (yellow)	19-10 – 20-10	ND	--	--	10 Ft ²	G
1st Floor	Breakroom air handling closet	Duct insulation (silver and yellow)	21-11 – 22-11	ND	--	--	5 LF	G
1st Floor	Breakroom air handling closet	Spray foam (yellow)	23-12 – 24-12	ND	--	--	2 Ft ²	G

Table 1
Asbestos Building Survey Results

Project 10011635_001

Page 2

Location		Suspect ACM Characteristics						
Homogeneous Area	Functional Space	Homogeneous Material Description	Ref. Client Sample No.	Asbestos Content (%) ¹	ACM Type ²	Category ³	Estimated Quantity (Units) ⁴	Material Condition ⁵
1st Floor	Breakroom	Window caulk (black)	25-13 – 26-13	ND	--	--	36 LF	G
Basement	East room	Pipe insulation (white and yellow)	27-14 – 28-14	ND	--	--	18 LF	G
Basement	East room	Pipe insulation (green and yellow)	29-15 – 30-15	ND	--	--	43 LF	G
Basement	West room	Pipe insulation (black)	31-16 – 32-16	ND	--	--	28 LF	G

1. Asbestos Content

Asbestos content is indicated as an approximate percent by area.

ND = None Detected

NA = Not Analyzed

"<" = less than

PC = Point Count Analysis detected < 1% asbestos content. Building material samples containing <1% asbestos are not considered to be ACM in accordance with the EPA and MDNR regulations.

2. ACM Type

Misc. = Miscellaneous Material

TSI = Thermal System Insulation Material

Surf. = Surfacing Material

4. Units

Ft² = square feet

LF = linear feet

EA = each

3. Category

F = Friable ACM

Cat. I = Category I non-friable ACM

Cat. II = Category II non-friable ACM

5. Condition of ACM:

G = Good/Not Damaged

D= Damaged

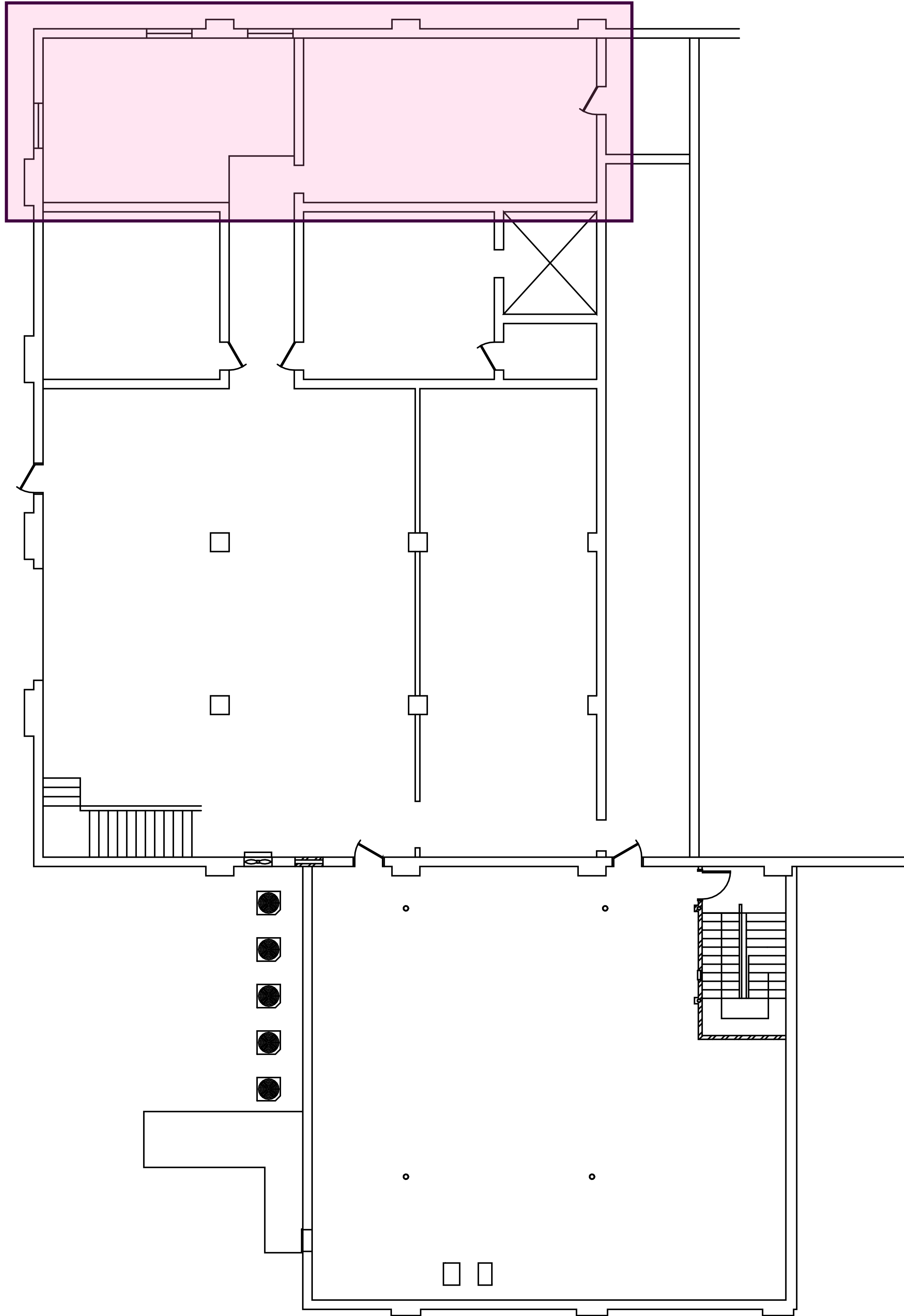
SD= Significantly Damaged

Appendix A.

A100 Floor Plan



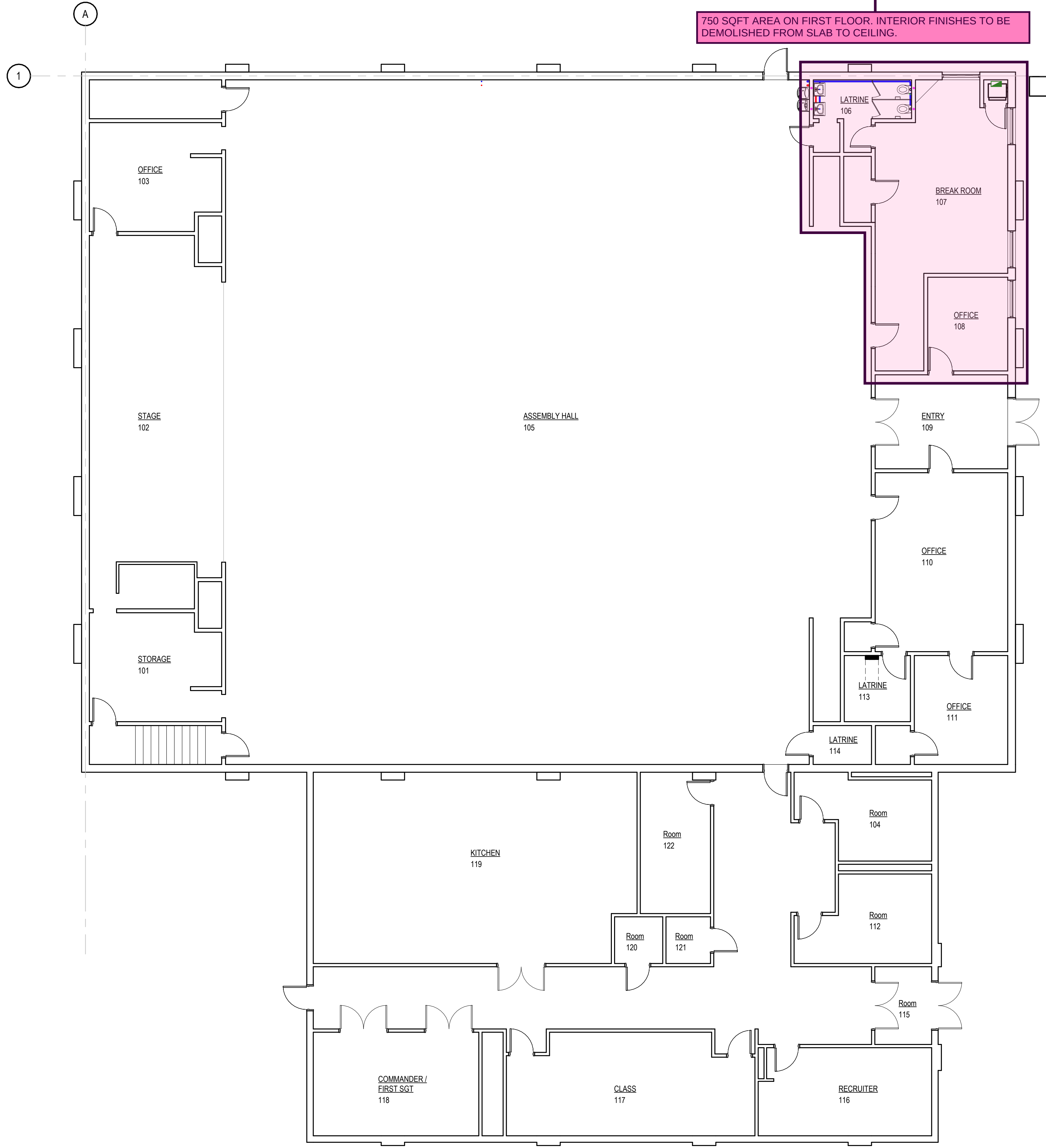
1,050 SQFT AREA WITHIN BASEMENT. ROOMS MOSTLY CONSIST OF PIPING AND DUCT ROUTING ITEMS FEEDING INTO AREA OF WORK ABOVE TO BE TESTED.



1 BASEMENT
SCALE: 1/8" = 1'-0"
0 4' 8' 16'



750 SQFT AREA ON FIRST FLOOR. INTERIOR FINISHES TO BE DEMOLISHED FROM SLAB TO CEILING.



2 LEVEL 01
SCALE: 1/8" = 1'-0"
0 4' 8' 16'

Chillicothe Readiness Center - USB Roof Replacement & Latrine Renovation

1500 Washington St.
Chillicothe, MO 64601

CE No.: 123-456-24
PNO
1/13/2026

DRAFT
PREPARED FOR PRELIMINARY
SUBMISSION AND REVIEW ONLY --
NOT FOR CONSTRUCTION

Appendix B.

Bulk Asbestos Analysis Reports



EMSL Analytical, Inc.

100 Green Park Industrial Court Saint Louis, MO 63123

Tel/Fax: (314) 577-0150 / (314) 776-3313

<http://www.EMSL.com> / saintlouislab@emsl.com

EMSL Order: 392602727

Customer ID: BRAU50

Customer PO: 10011635_001

Project ID:

Attention: David Ross

Braun Intertec

11001 Hampshire Avenue South

Bloomington, MN 55438

Phone: (785) 383-2920

Fax: (952) 995-2020

Received Date: 05/12/2026 12:15 PM

Analysis Date: 05/13/2026 - 05/15/2026

Collected Date: 04/30/2026

Project: Chillicothe Readiness Center

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
1-1 392602727-0001	Break Room - Ceiling tile, white 2x2	White Fibrous Homogeneous	28% Cellulose 37% Min. Wool	28% Perlite 7% Non-fibrous (Other)	None Detected
HA: 1					
2-1 392602727-0002	Break Room - Ceiling tile, 2x2 white	White Fibrous Homogeneous	27% Cellulose 38% Min. Wool	28% Perlite 7% Non-fibrous (Other)	None Detected
HA: 1					
3-2-Plaster 392602727-0003 No sheetrock or concrete present.	Break Room - Concrete, sheetrock material, white	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 2					
3-2-Plaster 392602727-0003A No sheetrock or concrete present.	Break Room - Concrete, sheetrock material, white	Various Non-Fibrous Homogeneous		19% Quartz 81% Non-fibrous (Other)	None Detected
HA: 2					
4-2-Plaster 392602727-0004 No sheetrock or concrete present.	Break Room - Concrete, sheetrock, white	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 2					
4-2-Plaster 392602727-0004A No sheetrock or concrete present.	Break Room - Concrete, sheetrock, white	Various Non-Fibrous Homogeneous		19% Quartz 81% Non-fibrous (Other)	None Detected
HA: 2					
5-3 392602727-0005	Break Room - Insulation joint, duct tape, gray	Gray Non-Fibrous Heterogeneous	36% Synthetic	64% Non-fibrous (Other)	None Detected
HA: 3					
6-3 392602727-0006	Break Room - Insulation joint, duct tape, gray	Gray Non-Fibrous Heterogeneous	39% Synthetic	61% Non-fibrous (Other)	None Detected
HA: 3					
7-4-Wrap 392602727-0007	Break Room - Insulation wrap, black & yellow	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 4					
7-4-Insulation 392602727-0007A	Break Room - Insulation wrap, black & yellow	Yellow Fibrous Homogeneous	94% Min. Wool	6% Non-fibrous (Other)	None Detected
HA: 4					
8-4-Wrap 392602727-0008	Break Room - Insulation wrap, black & yellow	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 4					

Initial report from: 05/15/2026 13:11:15



EMSL Analytical, Inc.

100 Green Park Industrial Court Saint Louis, MO 63123

Tel/Fax: (314) 577-0150 / (314) 776-3313

<http://www.EMSL.com / saintlouislab@emsl.com>

EMSL Order: 392602727

Customer ID: BRAU50

Customer PO: 10011635_001

Project ID:

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
8-4-Insulation 392602727-0008A	Break Room - Insulation wrap, black & yellow	Yellow Fibrous Homogeneous	97% Min. Wool HA: 4	3% Non-fibrous (Other)	None Detected
9-5-Cove Base 392602727-0009	Break Room - Cove base, gray w/ yellow mastic	Gray Non-Fibrous Homogeneous	 HA: 5	100% Non-fibrous (Other)	None Detected
9-5-Mastic 392602727-0009A	Break Room - Cove base, gray w/ yellow mastic	Yellow Non-Fibrous Homogeneous	 HA: 5	100% Non-fibrous (Other)	None Detected
10-5-Cove Base 392602727-0010	Break Room - Cove base, gray w/ yellow mastic	Gray Non-Fibrous Homogeneous	 HA: 5	100% Non-fibrous (Other)	None Detected
10-5-Mastic 392602727-0010A	Break Room - Cove base, gray w/ yellow mastic	Yellow Non-Fibrous Homogeneous	 HA: 5	100% Non-fibrous (Other)	None Detected
11-6 392602727-0011	Break Room - Floor seal caulk, white	White Non-Fibrous Homogeneous	 HA: 6	100% Non-fibrous (Other)	None Detected
12-6 392602727-0012	Break Room - Floor seal caulk, white	White Non-Fibrous Homogeneous	 HA: 6	100% Non-fibrous (Other)	None Detected
13-7-Flooring 392602727-0013	Break Room - Vinyl floor, gray, w/ yellow mastic	Gray Non-Fibrous Homogeneous	 HA: 7	100% Non-fibrous (Other)	None Detected
13-7-Mastic 392602727-0013A	Break Room - Vinyl floor, gray, w/ yellow mastic	Yellow Non-Fibrous Homogeneous	 HA: 7	100% Non-fibrous (Other)	None Detected
13-7-Leveler 392602727-0013B	Break Room - Vinyl floor, gray, w/ yellow mastic	Brown Non-Fibrous Homogeneous	 HA: 7	100% Non-fibrous (Other)	None Detected
14-7-Flooring 392602727-0014	Break Room - Vinyl floor, gray, w/ yellow mastic	Gray Non-Fibrous Homogeneous	 HA: 7	100% Non-fibrous (Other)	None Detected
14-7-Mastic 392602727-0014A	Break Room - Vinyl floor, gray, w/ yellow mastic	Yellow Non-Fibrous Homogeneous	 HA: 7	100% Non-fibrous (Other)	None Detected
15-8 392602727-0015	Bathroom - 1'x1' ceramic tile, gray/brown	Various Non-Fibrous Heterogeneous	 HA: 8	100% Non-fibrous (Other)	None Detected
16-8 392602727-0016	Bathroom - 1'x1' ceramic tile, gray/brown	Various Non-Fibrous Heterogeneous	 HA: 8	100% Non-fibrous (Other)	None Detected
17-9 392602727-0017	Bathroom - Ceramic grout, brown	Brown Non-Fibrous Homogeneous		13% Quartz 87% Non-fibrous (Other)	None Detected

Initial report from: 05/15/2026 13:11:15



EMSL Analytical, Inc.

100 Green Park Industrial Court Saint Louis, MO 63123

Tel/Fax: (314) 577-0150 / (314) 776-3313

<http://www.EMSL.com> / saintlouislabs@emsl.com

EMSL Order: 392602727

Customer ID: BRAU50

Customer PO: 10011635_001

Project ID:

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

			Non-Asbestos	Asbestos	
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
			HA: 9		
18-9	Bathroom - Ceramic grout, brown	Brown Non-Fibrous Homogeneous		15% Quartz 85% Non-fibrous (Other)	None Detected
392602727-0018			HA: 9		
19-10-Vinyl Floor Tile	Bathroom - 1x1 vinyl tile gray w/ yellow mastic	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0019			HA: 10		
19-10-Mastic	Bathroom - 1x1 vinyl tile gray w/ yellow mastic	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0019A			HA: 10		
20-10-Vinyl Floor Tile	Bathroom - 1x1 vinyl tile gray w/ yellow mastic	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0020			HA: 10		
20-10-Mastic	Bathroom - 1x1 vinyl tile gray w/ yellow mastic	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0020A			HA: 10		
21-11-Wrap	Bathroom - Duct insulation, silver & yellow	Silver Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0021			HA: 11		
21-11-Adhesive	Bathroom - Duct insulation, silver & yellow	Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0021A			HA: 11		
21-11-Insulation	Bathroom - Duct insulation, silver & yellow	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0021B			HA: 11		
22-11-Wrap	Bathroom - Duct insulation, silver & yellow	Silver Non-Fibrous Heterogeneous		100% Non-fibrous (Other)	None Detected
392602727-0022			HA: 11		
22-11-Adhesive	Bathroom - Duct insulation, silver & yellow	Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0022A			HA: 11		
22-11-Insulation	Bathroom - Duct insulation, silver & yellow	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0022B			HA: 11		
23-12	Bathroom - Spray foam insulation, yellow	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0023			HA: 12		
24-12	Bathroom - Spray foam insulation, yellow	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0024			HA: 12		
25-13	Bathroom - Window caulk, black	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
392602727-0025			HA: 13		

Initial report from: 05/15/2026 13:11:15



EMSL Analytical, Inc.

100 Green Park Industrial Court Saint Louis, MO 63123

Tel/Fax: (314) 577-0150 / (314) 776-3313

<http://www.EMSL.com> / saintlouislab@emsl.com

EMSL Order: 392602727

Customer ID: BRAU50

Customer PO: 10011635_001

Project ID:

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
26-13 392602727-0026	Bathroom - Window caulk, black	Black Non-Fibrous Homogeneous	HA: 13	100% Non-fibrous (Other)	None Detected
27-14-Wrap 392602727-0027	Basement - Pipe insulation, white & yellow	White Fibrous Heterogeneous	HA: 14 39% Cellulose 19% Glass	42% Non-fibrous (Other)	None Detected
27-14-Insulation 392602727-0027A	Basement - Pipe insulation, white & yellow	Yellow Fibrous Homogeneous	HA: 14 96% Min. Wool	4% Non-fibrous (Other)	None Detected
28-14-Wrap 392602727-0028	Basement - Pipe insulation, white & yellow	White Fibrous Heterogeneous	HA: 14 34% Cellulose 22% Glass	44% Non-fibrous (Other)	None Detected
28-14-Insulation 392602727-0028A	Basement - Pipe insulation, white & yellow	Yellow Fibrous Homogeneous	HA: 14 98% Min. Wool	2% Non-fibrous (Other)	None Detected
29-15 392602727-0029	Basement - Pipe insulation, green & yellow	Various Fibrous Homogeneous	HA: 15 93% Min. Wool	7% Non-fibrous (Other)	None Detected
30-15 392602727-0030	Basement - Pipe insulation, black	Various Fibrous Homogeneous	HA: 16 96% Min. Wool	4% Non-fibrous (Other)	None Detected
31-16 392602727-0031		Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
32-16 392602727-0032		Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Analyst(s)

Oliver Malone (24)

Sue Ferrario (25)

Jeff Siria, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Saint Louis, MO NVLAP Lab Code 200742-0, CA 2668, OR 4194-001

Initial report from: 05/15/2026 13:11:15

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody

EMSL Order Number (Lab Use Only):

392602727

Company Name : Braun Intertec Corporation		EMSL Customer ID: BRAU50	
Street: 11529 W. 79 th Street		City: Lenexa	State/Province: KS
Zip/Postal Code: 66214	Country: US	Telephone #: 816-591-2855	Fax #:
Report To (Name): Dave Ross		Please Provide Results: ☐ Fax ☒ Email	
Email Address: DRoss@braunintertec.com		Purchase Order: 10011635_001	
Project Name/Number: Chillicothe Readiness Center		EMSL Project ID (Internal Use Only):	
U.S. State Samples Taken: Missouri		CT Samples: ☐ Commercial/Taxable ☐ Residential/Tax Exempt	
EMSL Bill to: ☐ Same ☒ Different - If Bill to is Different note instructions in Comments** Third Party Billing requires written authorization from third party			
Turnaround Time (TAT) Options* - Please Check			
☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☒ 72 Hour ☐ 96 Hour ☐ 1 Week ☐ 2 Week			
*For TEM Air 3 hr through 6 hr, please call ahead to schedule. *There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.			
PCM - Air ☐ Check if samples are from NY ☐ NIOSH 7400 ☐ w/ OSHA 8hr. TWA PLM - Bulk (reporting limit) ☒ PLM EPA 600/R-93/116 (<1%) ☐ PLM EPA NOB (<1%) Point Count ☐ 400 (<0.25%) ☐ 1000 (<0.1%) Point Count w/Gravimetric ☐ 400 (<0.25%) ☐ 1000 (<0.1%) ☐ NYS 198.1 (friable in NY) ☐ NYS 198.6 NOB (non-friable-NY) ☐ NYS 198.8 SOF-V ☐ NIOSH 9002 (<1%)		TEM - Air ☐ 4-4.5hr TAT (AHERA only) ☐ AHERA 40 CFR, Part 763 ☐ NIOSH 7402 ☐ EPA Level II ☐ ISO 10312 TEM - Bulk ☐ TEM EPA NOB ☐ NYS NOB 198.4 (non-friable-NY) ☐ Chatfield SOP ☐ TEM Mass Analysis-EPA 600 sec 2.5 TEM - Water: EPA 100.2 Fibers >10µm ☐ Waste ☐ Drinking All Fiber Sizes ☐ Waste ☐ Drinking	
TEM - Dust ☐ Microvac - ASTM D 5755 ☐ Wipe - ASTM D6480 ☐ Carpet Sonication (EPA 600/J-93/167) Soil/Rock/Vermiculite* ☐ PLM CARB 435 - A (0.25% sensitivity) ☐ PLM CARB 435 - B (0.1% sensitivity) ☐ TEM CARB 435 - B (0.1% sensitivity) ☐ TEM CARB 435 - C (0.01% sensitivity) ☐ TEM Qual. via Filtration Technique ☐ TEM Qual. via Drop-Mount Technique *Can not accept New York State Loose Fill Vermiculite Samples Other: ☒ Point count if <1% asbestos.			
☒ Check For Positive Stop - Clearly Identify Homogenous Group		Filter Pore Size (Air Samples) ☐ 0.8µm ☐ 0.45µm	
Samplers Name: Bo Morland		Samplers Signature:	
Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
1-1	Break Room; Ceiling tile, white 3x2		04/30/2026
2-1	Ceiling tile, 2x2 white		
3-2	Concrete, sheetrock material, white		
4-2	Concrete, sheetrock, white		
5-3	Insulation joint, Duct tape, gray		
6-3			
7-7	Insulation & wrap, black & yellow		
Client Sample # (s): 32		Total # of Samples: 32	
Relinquished (Client):		Date: 05/10/2026 Time: 1647	
Received (Lab):		Date: 5/12/26 Time: 12:15	
Comments/Special Instructions: Invoice to Jerry Fong (JFong@braunintertec.com), 11004 Hampshire Avenue South, Minneapolis, MN 55448			

392602727

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody
 Page 2 of 2 pages
 (Only)

INDUSTRIAL COURT
 10000 10th Ave
 Denver, CO 80231
 (303) 751-1000

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
8-9	Insulation wrap, black & yellow		
9-5	Cove base, gray w/ yellow mastic		
10-5	↓		
11-6	Floor seal/caulk, white		
12-6	↓		
13-7	Vinyl floor, gray, w/ yellow mastic		
14-7	↓		
15-8	Bathroom 1'x1' Ceramic tile, gray/brown		
16-8	↓		
17-9	Ceramic grout, brown		
18-9	↓		
19-10	1'x1' vinyl tile gray w/ yellow mastic		
20-10	↓		
21-11	Duct insulation, silver & yellow		
22-11	↓		
23-12	Spray foam insulation, yellow		
24-12	↓		
25-13	Window caulk, black		
26-13	↓		
27-14	Basement, Pipe insulation, white & yellow		
28-14	↓		
29+30-15	Pipe insulation, green & yellow		
31+32-16	Pipe insulation, black		

*Comments/Special Instructions:

Appendix C.

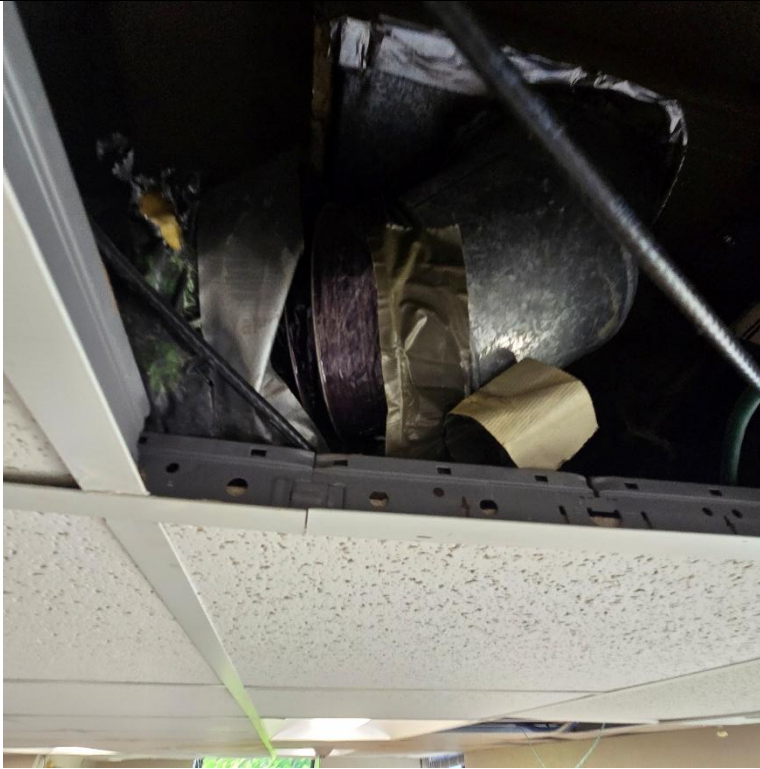
Photographic Log



Photograph 1	4/30/2026
Location:	Breakroom
Subject:	2-feet by 2-feet ceiling tile (white); Samples 1-1 – 2-1



Photograph 2	4/30/2026
Location:	Breakroom
Subject:	Plaster with texture (white); Samples 3-2 – 4-2



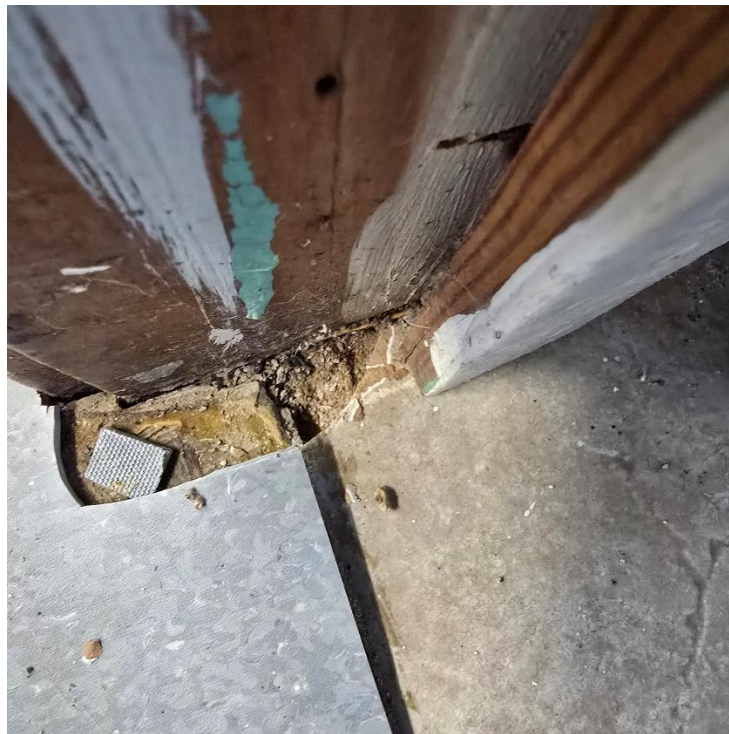
Photograph 3	4/30/2026
Location:	Breakroom above ceiling
Subject:	Insulation tape (gray) and wrap (black and yellow); Samples 5-3 – 8-4



Photograph 4	4/30/2026
Location:	Breakroom
Subject:	Cove base (gray) with mastic (yellow); Samples 9-5 – 10-5



Photograph 5	4/30/2026
Location:	Breakroom
Subject:	Floor seal caulk (white); Samples 11-6 – 12-6



Photograph 6	4/30/2026
Location:	Breakroom
Subject:	12-inch by 12-inch vinyl floor tile (gray) with mastic (yellow); Samples 13-7 – 14-7



Photograph 7	4/30/2026
Location:	Bathroom
Subject:	1-foot by 1-foot ceramic floor tile (gray) with grout (brown); Samples 15-8 – 18-9



Photograph 8	4/30/2026
Location:	Breakroom air handling closet
Subject:	1-foot by 1-foot vinyl floor tile (gray) with mastic (yellow); Samples 19-10 – 20-10



Photograph 9	4/30/2026
Location:	Breakroom air handling closet
Subject:	Duct insulation (silver and yellow); Samples 21-11 – 22-11



Photograph 10	4/30/2026
Location:	Breakroom air handling closet
Subject:	Spray foam (yellow); Samples 23-12 – 24-12



Photograph 11	4/30/2026
Location:	Breakroom
Subject:	Window caulk (black); Samples 25-13 – 26-13



Photograph 12	4/30/2026
Location:	Basement
Subject:	Pipe insulation (white and yellow); Samples 27-14 – 28-14



Photograph 13	4/30/2026
Location:	Basement
Subject:	Pipe insulation (green and yellow); Samples 29-15 – 30-15



Photograph 14	4/30/2026
Location:	Basement
Subject:	Pipe insulation (black); Samples 31-16 – 32-16

Appendix D.

Certifications

CERTIFICATION NUMBER:
7011091125MOIR23100

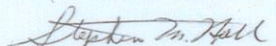
THIS CERTIFIES
Warren H Moreland
HAS COMPLETED THE CERTIFICATION

REQUIREMENTS FOR
Inspector



APPROVED: **10/27/2025**
EXPIRES: **09/11/2026**

TRAINING DATE: **09/11/2025**


Director of Air Pollution Control Program



M·E·T·A
Mayhew Environmental Training Associates
I N C O R P O R A T E D

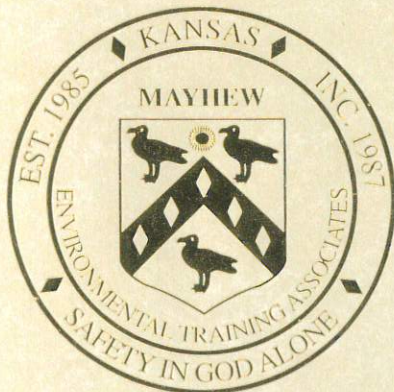
Certificate # G7F5CZMBB5

Warren "Bo" Moreland

*has on 9/11/2025, in Lawrence, KS
completed the requirements for asbestos accreditation under Section 206 of TSCA Title II, 15 USC 2646*

Asbestos Inspector Refresher

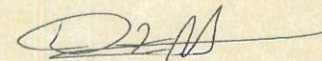
*as approved by MO & the US EPA under 40 CFR 763 (AHERA) from 9/11/2025 to 9/11/2025
and
passed the associated exam on 9/11/2025 with a score of at least 70%*



P.O. Box 786 - Lawrence, KS. 66044 - 800.444.6382
www.metaenvironmental.net

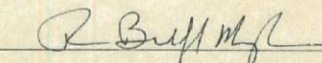
SSN: XXX-XX-9604

Expiration: 9/11/2026



DeMarcus Lockett

Instructor



Thomas Mayhew
President