



PROJECT MANUAL

Renovation to Exterior/Interior

RC Building

Warrensburg Readiness Center

Warrensburg, Missouri

Designed By: Clark & Enersen
2020 Baltimore Avenue
Suite 300
Kansas City, MO 64108

Date Issued: December 29, 2023

Project No.: T2306-01

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION
Facilities Management, Design & Construction

SECTION 00 01 07 – PROFESSIONAL SEALS & CERTIFICATIONS



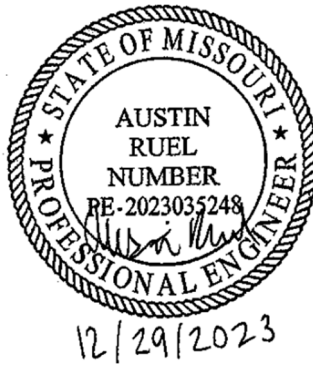
Architect
(Coordinating Professional)



Civil Engineer



Electrical Engineer



Mechanical Engineer

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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	12/29/23
2.	General Notes, Symbols & Abbreviations and Sheet Index	Sheet G-001	12/29/23
3.	ADA Details	Sheet G-002	12/29/23
4.	ADA Details	Sheet G-003	12/29/23
5.	Code Compliance Plan	Sheet G-004	12/29/23
6.	Site Utility Plan	Sheet C-101	12/29/23
7.	Site Utility Details	Sheet C-102	12/29/23
8.	Wall Type Schedule & Details	Sheet A-000	12/29/23
9.	Base Bid Demolition Plans	Sheet A-100	12/29/23
10.	Alternates Demolition Plan	Sheet A-100A	12/29/23
11.	Base Bid Floor Plans	Sheet A-101	12/29/23
12.	Alternates Floor Plan	Sheet A-101A	12/29/23
13.	First Floor Demolition Reflected Ceiling Plan	Sheet A-102	12/29/23
14.	First Floor Reflected Ceiling Plan	Sheet A-103	12/29/23
15.	Enlarged Restroom Plans, Elevations, Schedule & Details	Sheet A-104	12/29/23
16.	Exterior Elevations	Sheet A-300	12/29/23
17.	Door Schedule, Door Types & Frame Types	Sheet A-500	12/29/23
18.	First Floor Finishes Plan, Finish Schedule, Legend and Details	Sheet F-100	12/29/23
19.	First Floor Finish Plans – Alternates	Sheet F-101	12/29/23
20.	Foodservice Equipment Plan & Schedule	Sheet FS-100	12/29/23

21.	Foodservice Elevations and Details	Sheet FS-101	12/29/23
22.	Mechanical Abbreviations, Symbols & Notes	Sheet M-000	12/29/23
23.	First Floor HVAC Demo Plan	Sheet M-001	12/29/23
24.	First Floor HVAC Plan	Sheet M-101	12/29/23
25.	Mechanical Details	Sheet M-201	12/29/23
26.	Mechanical Details	Sheet M-202	12/29/23
27.	Mechanical Controls	Sheet M-301	12/29/23
28.	Mechanical Schedules	Sheet M-401	12/29/23
29.	Mechanical Schedules	Sheet M-402	12/29/23
30.	Below Floor Plumbing Demo Plan	Sheet P-001	12/29/23
31.	First Floor Plumbing Demo Plan	Sheet P-002	12/29/23
32.	Below Floor Plumbing Plan	Sheet P-101	12/29/23
33.	First Floor Plumbing Plan	Sheet P-102	12/29/23
34.	Plumbing Details	Sheet P-201	12/29/23
35.	Plumbing Schematics	Sheet P-301	12/29/23
36.	Plumbing Risers	Sheet P-302	12/29/23
37.	Plumbing Schedules	Sheet P-401	12/29/23
38.	Plumbing Schedules	Sheet P-402	12/29/23
39.	Mechanical Roof Plan	Sheet PM-101	12/29/23
40.	Electrical Abbreviations, Symbols Legend & General Notes	Sheet E-000	12/29/23
41.	First Floor Electrical Demolition Plans	Sheet E-010	12/29/23
42.	First Floor Electrical Orientation Plan	Sheet E-100	12/29/23
43.	First Floor Electrical Orientation Plan Notes	Sheet E-100A	12/29/23
44.	First Floor Lighting Plans	Sheet E-111	12/29/23
45.	First Floor Power & Auxiliary Systems Plan - Base Bid Kitchen	Sheet E-211	12/29/23
46.	First Floor Power & Auxiliary Systems Plans	Sheet E-212	12/29/23
47.	First Floor Fire Alarm Plan - Base Bid	Sheet E-301	12/29/23
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49.	Electrical One Line Diagram – New	Sheet E-402	12/29/23
50.	Electrical Schedules	Sheet E-501	12/29/23
51.	Electrical Schedules	Sheet E-502	12/29/23
52.	Electrical Details	Sheet E-601	12/29/23
53.	Electrical Details	Sheet E-602	12/29/23

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. Renovation to Exterior/Interior RC Building
Warrensburg Readiness Center
Warrensburg, Missouri
Project No.: T2306-01

3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, May 23, 2024
- B. **Only electronic bids on MissouriBUYS shall be accepted: <https://missouribuys.mo.gov>. Bidder must be registered to bid.**

4.0 DESCRIPTION:

- A. Scope: The project includes the renovation of two new sets of restrooms, a new kitchen design, a new floor to cover the existing stairs to the basement level, renovation to the existing supply office, and renovation to the workout space. Alternates include renovating the supply office, demolishing the west offices (3) and renovating the space to create a fitness room, replacing all interior doors and flooring in carpeted office spaces with LVT, resealing the drill hall, replacing existing blinds with aluminum commercial grade blinds, and replacing the caging adjacent to the supply office.
- B. MBE/WBE/SDVE Goals: MBE 10%, WBE 10%, 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.**
- C. ****NOTE:** Bidders are provided new Good Faith Effort (GFE) forms on MissouriBUYS.
- D. In addition to the State of Missouri MBE/WBE/SDVE participation goals set forth herein and in the bid documents for this project, the contractor on a federally funded/assisted construction project is subject to federal Executive Order 11246. The Bidder's attention is drawn to the Notice of Requirement for Affirmative Action To Ensure Equal Employment Opportunity (Executive Order 11246, 41 C.F.R. 60-4.2) in Section 007333, SUPPLEMENTARY GENERAL CONDITIONS FOR FEDERALLY FUNDED/ASSISTED CONSTRUCTION PROJECTS, which is incorporated by reference.

5.0 PRE-BID MEETING:

- A. Place/Time: 10:00 AM, May 9, 2024, at Warrensburg Readiness Center, 343 Gay Street, Warrensburg, Missouri
- 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. Designer: Clark & Enersen, Rick Wise, 816-474-8237, email: rick.wise@clarkenersen.com
- B. Project Manager: Sandra Walther, 573-257-7322, email: sandra.walther@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.

- C. This is a federally funded/assisted construction project that requires compliance by the awarded contractor with applicable federal laws and regulations. The Bidder should review Section 007333, SUPPLEMENTARY GENERAL CONDITIONS FOR FEDERALLY FUNDED/ASSISTED CONSTRUCTION PROJECTS, which is made part of this solicitation and will be made part of the resulting contract by reference.
- D. The State of Missouri, OA-FMDC, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, businesses owned and controlled by socially and economically disadvantaged individuals will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, religion, creed, sex, age, ancestry or national origin in consideration for an award.

Very Important MissouriBUYS Instructions to Help Submit a Bid Correctly

- A. The bidder shall submit his or her bid and all supporting documentation on MissouriBUYS eProcurement System. No hard copy bids shall be accepted. Go to <https://missouribuys.mo.gov> and register. The bidder must register and complete a profile fully with all required documents submitted prior to submitting a bid.
- B. Once registered, log in.
1. Under "Solicitation" select "View Current Solicitations."
 2. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8", then click "Filter Solicitation" button.
 3. Select "Active Solicitations" tab.
 4. To see the Solicitation Summary, click on the Project Number and the summary will open. Click each heading to open detailed information.
- C. Here are simplified instructions for uploading the bid to MissouriBUYS:
1. Find the solicitation by completing Steps 1 through 4 above.
 2. Select the three dots under "Actions." Select "Add New Response."
 3. When the Quote box opens, give the response a title and select "OK."
 4. The detailed solicitation will open. Select "Check All" for the Original Solicitation Documents, open each document, and select "Accept." If this step is not completed, a bid cannot be uploaded. Scroll to the bottom of the page and select "Add Attachments." If you do not see this command, not all documents have been opened and accepted.
 5. The Supplier Attachments box will open. Select "Add Attachment" again.
 6. The Upload Documents box will open. Read the instructions for uploading. Disregard the "Confidential" check box.
 7. Browse and attach up to 5 files at a time. Scroll to bottom of box and select "Upload." The Supplier Attachments box will open. Repeat Steps 5 through 7 if more than 5 files are to be uploaded.
 8. When the Supplier Attachments box opens again and uploading is complete, select "Done." A message should appear that the upload is successful. If it does not, go to the Bidder Response tab and select "Submit."
 9. The detailed solicitation will open. At the bottom select "Close."
- D. Any time a bidder wants to modify the bid, he or she will have to submit a new one. FMDC will open the last response the bidder submits. The bidder may revise and submit the bid up to the close of the solicitation (bid date and time). Be sure to allow for uploading time so that the bid is successfully uploaded prior to the 1:30 PM deadline; we can only accept the bid if it is uploaded before the deadline.
- E. If you want to verify that you are uploading documents correctly, please contact Paul Girouard: 573-751-4797, paul.girouard@oa.mo.gov ; April Howser: 573-751-0053, April.Howser@oa.mo.gov ; or Mandy Roberson: 573-522-0074, Mandy.Roberson@oa.mo.gov.
- F. If you are experiencing login issues, please contact Web Procure Support (Proactis) at 866-889-8533 anytime from 7:00 AM to 7:00 PM Central Time, Monday through Friday. If you try using a userid or password several times that is incorrect, the system will lock you out. Web Procure Support is the only option to unlock you! If you forget your userid or password, Web Procure Support will provide a temporary userid or password. Also, if it has been a while since your last successful login and you receive an "inactive" message, contact Web Procure (Proactis). If you are having a registration issue, you may contact Cathy Holliday at 573-751-3491 or by email: cathy.holliday@oa.mo.gov.

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 any one (1) party may be limited in accordance with available supply.
- B. For the convenience of contractors, sub-contractors and suppliers, copies of construction documents are on file at the office of the Director, Division of Facilities Management, Design and Construction and on the Division's web site - <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

3.0 - BIDDERS' OBLIGATIONS

- A. Bidders must carefully examine the entire site of the work and shall make all reasonable and necessary investigations to inform themselves thoroughly as to the facilities available as well as to all the difficulties involved in the completion of all work in accordance with the specifications and the plans. Bidders are also required to examine all maps, plans and data mentioned in the specifications. No plea of ignorance concerning observable existing conditions or difficulties that may be encountered in the execution of the work under this contract will be accepted as an excuse for any failure or omission on the part of the contractor to fulfill in every detail all of the requirements of the contract, nor accepted as a basis for any claims for extra compensation.
- B. Under no circumstances will contractors give their plans and specifications to another contractor. Any bid received from a contractor whose name does not appear on the list of plan holders may be subject to rejection.

4.0 - INTERPRETATIONS

- A. No bidder shall be entitled to rely on oral interpretations as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction. Every request for interpretation shall be made in writing and submitted with all supporting documents not less than five (5) working days before opening of bids. Every interpretation made to a bidder will be in the form of an addendum and will be sent as promptly as is practicable to all persons to whom plans and specifications have been issued. All such addenda shall become part of the contract documents.
- B. Approval for an "acceptable substitution" issued in the form of an addendum as per Paragraph 4A above, and as per Article 3.1 of the General Conditions; ACCEPTABLE SUBSTITUTIONS shall constitute approval for use in the project of the product.
- C. An "acceptable substitution" requested after the award of bid shall be approved if proven to the satisfaction of the Owner and the Designer as per Article 3.1, that the product is acceptable in design, strength, durability, usefulness, and convenience for the purpose intended. Approval of the substitution after award is at the sole discretion of the Owner.
- D. A request for "Acceptable Substitutions" shall be made on the Section 006325 Substitution Request Form. The request shall be sent directly to the project Designer. A copy of said request should also be mailed to the Owner, Division of Facilities Management, Design and Construction, Post Office Box 809, Jefferson City, Missouri 65102.

5.0 - BIDS AND BIDDING PROCEDURE

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

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

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

004113	Bid Form (all pages are always required)
004322	Unit Prices Form
004336	Proposed Subcontractors Form
004337	MBE/WBE/SDVE Compliance Evaluation Form
004338	MBE/WBE/SDVE Eligibility Determination for Joint Ventures
004339	MBE/WBE/SDVE GFE Determination
004340	SDVE Business Form
004541	Affidavit of Work Authorization
004545	Anti-Discrimination Against Israel Act Certification form

- B. All bids shall be submitted without additional terms and conditions, modification or reservation on the bid forms with each space properly filled. Bids not on these forms will be rejected.
- C. All bids shall be accompanied by a bid bond executed by the bidder and a duly authorized surety company, certified check, cashier's check or bank draft made payable to the Division of Facilities Management, Design and Construction, State of Missouri, in the amount indicated on the bid form, Section 004113. Failure of the contractor to submit the full amount required shall be sufficient cause to reject his bid. The bidder agrees that the proceeds of the check, draft or bond shall become the property of the State of Missouri, if for any reason the bidder withdraws his bid after closing, or if on notification of award refuses or is unable to execute tendered contract, provide an acceptable performance and payment bond, provide evidence of required insurance coverage and/or provide required copies of affirmative action plans within ten (10) working days after such tender.
- D. The check or draft submitted by the successful bidder will be returned after the receipt of an acceptable performance and payment bond and execution of the formal contract. Checks or drafts of all other bidders will be returned within a reasonable time after it is determined that the bid represented by same will receive no further consideration by the State of Missouri. Bid bonds will only be returned upon request.

6.0 - SIGNING OF BIDS

- A. A bid from an individual shall be signed as noted on the Bid Form.
- B. A bid from a partnership or joint venture shall require only one signature of a partner, an officer of the joint venture authorized to bind the venture or an attorney-in-fact. If the bid is signed by an officer of a joint venture or an attorney-in-fact, a document evidencing the individual's authority to execute contracts should be included with the bid form.
- C. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.
- D. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation manually written. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual. Corporate license number shall be provided and, if a corporation organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached. In addition, for corporate proposals, the President or Vice-President should sign as the bidder. If the signator is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signator has the legal authority to bind the corporation.

- E. A bid should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form should appear as shown in the Secretary of State's records.
- F. The Bidder should include its corporate license number on the Bid Form and, if the corporation is organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached to the bid form.

7.0 - RECEIVING BID SUBMITTALS

- A. It is the bidder's sole responsibility to assure receipt by Owner of bid submittals by the date and time specified in the Invitation for Bid. Bids received after the date and time specified shall not be considered by the Owner.
- B. Bids must be submitted through the MissouriBUYS statewide eProcurement system (<https://www.missouribuys.mo.gov/>) in accordance with the instructions for that system. The Owner shall only accept bids submitted through MissouriBUYS. Bids received by the Owner through any other means, including hard copies, shall not be considered and will be discarded by the Owner unopened.
- C. To respond to an Invitation for Bid, the Bidder must first register with MissouriBUYS by going through the MissouriBUYS Home Page (<https://www.missouribuys.mo.gov/>), clicking the "Register" button at the top of the page, and completing the Vendor Registration. Once registered, the Bidder accesses its account by clicking the "Login" button at the top of the MissouriBUYS Home Page. Enter your USERID and PASSWORD, which the Bidder will select. Under Solicitations, select "View Current Solicitations." A new screen will open. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8." Under "Filter by Opp. No." type in the State Project Number. Select "Submit." Above the dark blue bar, select "Other Active Opportunities." To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information. The Bidder must read and accept the Original Solicitation Documents and complete all identified requirements. The Bidder should download and save all of the Original Solicitation Documents on its computer so that the Bidder can prepare its response to these documents. The Bidder should upload its completed response to the downloaded documents as an attachment to the electronic solicitation response.
- D. Step-by-step instructions for how a registered vendor responds to a solicitation electronically are provided in Section 001116 – Invitation For Bid.
- E. The Bidder shall submit its bid on the forms provided by the Owner on MissouriBUYS with each space fully and properly completed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner may reject bids that are not on the Owner's forms or that do not contain all requested information.
- F. No Contractor shall stipulate in his bid any conditions not contained in the specifications or standard bid form contained in the contract documents. To do so may subject the Contractor's bid to rejection.
- G. The completed forms shall be without interlineations, alterations or erasures.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

- A. Bidder may withdraw his bid at any time prior to scheduled closing time for receipt of bids, but no bidder may withdraw his bid for a period of twenty (20) working days after the scheduled closing time for receipt of bids.
- B. The Bidder shall modify his or her original bid by submitting a revised bid on MissouriBUYS.

9.0 - AWARD OF CONTRACT

- A. The Owner reserves the right to reject any and/or all bids and further to waive all informalities in bidding when deemed in the best interest of the State of Missouri.
- B. The Owner reserves the right to let other contracts in connection with the work, including but not by way of limitation, contracts for the furnishing and installation of furniture, equipment, machines, appliances and other apparatus.

- C. The Owner shall award a contract to the lowest, responsive, 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 bid shall be considered binding upon the Owner until the written contract has been properly executed, a satisfactory bond has been furnished, evidence of required insurance coverage, submittal of executed Section 004541, Affidavit of Work Authorization form, documentation evidencing enrollment and participation in a federal work authorization program has been received and an affirmative action plan submitted. Failure to execute and return the contract and associated documents within the prescribed period of time shall be treated, at the option of the Owner, as a breach of bidder's obligation and the Owner shall be under no further obligation to bidder.
- F. If the successful bidder is doing business in the State of Missouri under a fictitious name, he shall furnish to Owner, attached to the Bid Form, a properly certified copy of the certificate of Registration of Fictitious Name from the State of Missouri, and such certificate shall remain on file with the Owner.
- G. Any successful bidder which is a corporation organized in a state other than Missouri shall furnish to the Owner, attached to the Bid Form, a properly certified copy of its current Certificate of Authority to do business in the State of Missouri, such certificate to remain on file with the Owner. No contract will be awarded by the Owner unless such certificate is furnished by the bidder.
- H. Any successful bidder which is a corporation organized in the State of Missouri shall furnish at its own cost to the Owner, if requested, a Certificate of Good Standing issued by the Secretary of State, such certificate to remain on file with the Owner.
- I. Transient employers subject to Sections 285.230 and 285.234, RSMo, (out-of-state employers who temporarily transact any business in the State of Missouri) may be required to file a bond with the Missouri Department of Revenue. No contract will be awarded by the Owner unless the successful bidder certifies that he has complied with all applicable provisions of Section 285.230-234.
- J. Sections 285.525 and 285.530, RSMo, require business entities to enroll and participate in a federal work authorization program in order to be eligible to receive award of any state contract in excess of \$5,000. Bidders should submit with their bid an Affidavit of Work Authorization (Section 004541) along with appropriate documentation evidencing such enrollment and participation. Section-004541, Affidavit of Work Authorization is located on the MissouriBUYS solicitation for this project. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding an E-Verify is located at <https://www.uscis.gov/e-verify/>. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

10.0 - CONTRACT SECURITY

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

11.0 - LIST OF SUBCONTRACTORS

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

12.0 - WORKING DAYS

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

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

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

14.0 – ANTI-DISCRIMINATION AGAINST ISRAEL ACT CERTIFICATION:

- A. Pursuant to section 34.600, RSMo, 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 as defined in section 34.600, RSMo, 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 requested to complete and submit the applicable portion of Section 004545 - Anti-Discrimination Against Israel Act Certification with their 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. If the exhibit is not submitted, the Owner shall rescind its Intent to Award and move to the next lowest, responsive, responsible bidder.

15.0 - MBE/WBE/SDVE INSTRUCTIONS

- A. Definitions:
 - 1. “**MBE**” means a Minority Business Enterprise.
 - 2. “**MINORITY**” has the same meaning as set forth in 1 C.S.R. 10-17.010.
 - 3. “**MINORITY BUSINESS ENTERPRISE**” has the same meaning as set forth in section 37.020, RSMo.
 - 4. “**WBE**” means a Women’s Business Enterprise.
 - 5. “**WOMEN’S BUSINESS ENTERPRISE**” has the same meaning as set forth in section 37.020, RSMo.
 - 6. “**SDVE**” means a Service-Disabled Veterans Enterprise.
 - 7. “**SERVICE-DISABLED VETERAN**” has the same meaning as set forth in section 34.074, RSMo.
 - 8. “**SERVICE-DISABLED VETERAN ENTERPRISE**” has the same meaning as “Service-Disabled Veteran Business” set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

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

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

1. A Bidder who is a MBE, WBE, or SDVE may count 100% of the contract towards the MBE, WBE or SDVE goal, less any amounts awarded to another MBE, WBE or SDVE. (NOTE: A MBE firm that bids as general contractor must obtain WBE and SDVE participation; a WBE firm that bids as a general contractor must obtain MBE and SDVE participation; and a SDVE firm that bids as general contractor must obtain MBE and WBE participation.) In order for the remaining contract amount to be counted towards the MBE, WBE or SDVE goal, the Bidder must complete the MBE/WBE/SDVE Compliance Evaluation Form (Section 004337) identifying itself as an MBE, WBE or SDVE.
2. The total dollar value of the work granted to a certified MBE, WBE or SDVE by the Bidder shall be counted towards the applicable goal.
3. Expenditures for materials and supplies obtained from a certified MBE, WBE, or SDVE supplier or manufacturer may be counted towards the MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.
4. The total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier may be counted towards a Bidder's MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE properly assumes the actual and contractual responsibility for the work.
5. The total dollar value of work granted to a certified joint venture equal to the percentage of the ownership and control of the MBE, WBE, or SDVE partner in the joint venture may be counted towards the MBE/WBE/SDVE goals.
6. Only expenditures to a MBE, WBE, or SDVE that performs a commercially useful function in the work may be counted towards the MBE, WBE and SDVE goals. A MBE, WBE, or SDVE performs a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by actually performing, managing and supervising the work or providing supplies or manufactured materials.

D. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Administration, Division of Purchasing and Material Management or by the Department of Veterans Affairs.
2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)'s online MBE/WBE directory (<https://apps1.mo.gov/MWBCertifiedFirms/>). The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Division of Purchasing and Materials Management's online SDVE directory (<https://oa.mo.gov/sites/default/files/sdvelisting.pdf>) or the Department of Veterans Affairs' directory (<https://vetbiz.va.gov/basic-search/>).
3. Additional information, clarifications, etc., regarding the listings in the directories may be obtained by calling the Division at (573)751-3339 and asking to speak to the Contract Specialist of record as shown in the Supplementary Conditions (Section 007300).

E. Waiver of MBE/WBE/SDVE Participation:

1. If a Bidder has made a good faith effort to secure the required MBE, WBE and/or SDVE participation and has failed, the Bidder shall submit with its bid the information requested in MBE/WBE/SDVE Good Faith Effort (GFE) Determination form. The GFE forms are located on the MissouriBUYS solicitation for this project. The Director will determine if the Bidder made a good faith effort to meet the applicable goals. If the Director determines that the Bidder did not make a good faith effort, the bid shall be rejected as being nonresponsive to the bid requirements. Bidders who demonstrate that they have made a good faith effort to include MBE, WBE, and/or SDVE participation will be determined to be responsive to the applicable participation goals, regardless of the percent of actual participation obtained, if the bid is otherwise acceptable.
2. In determining whether a Bidder has made a good faith effort to obtain MBE, WBE and/or SDVE participation, the Director may evaluate the factors set forth in 1 CSR 30-5.010(6)(C) and the following:
 - a. The amount of actual participation obtained;
 - b. How and when the Bidder contacted potential MBE, WBE, and SDVE subcontractors and suppliers;
 - c. The documentation provided by the Bidder to support its contacts, including whether the Bidder provided the names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;
 - d. If project information, including plans and specifications, were provided to MBE/WBE/SDVE subcontractors;
 - e. Whether the Bidder made any attempts to follow-up with MBE, WBE or SDVE firms prior to bid;
 - f. Amount of bids received from any of the subcontractors and/or suppliers that the Bidder contacted;
 - g. The Bidder's stated reasons for rejecting any bids;
3. If no bidder has obtained any participation in a particular category (MBE/WBE/SDVE) or made a good faith effort to do so, the Director may waive that goal rather than rebid.

F. Contractor MBE/WBE/SDVE Obligations

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

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

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

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

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

<https://o eo .mo .gov /sdve -certification -program />

<https://veterans.certify.sba.gov/#search>



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, on behalf of the Department of National Guard.

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

ARTICLE 1. STATEMENT OF WORK

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

Project Name: **Renovation to Exterior/Interior RC Building
Warrensburg Readiness Center
Warrensburg, Missouri**

Project Number: **T2306-01**

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 **240 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:	\$
Alternate No. 1:	\$
Alternate No. 2:	\$
Alternate No. 3:	\$
Alternate No. 4:	\$
TOTAL CONTRACT AMOUNT:	(\$CONTRACT 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 10% MBE and 10% WBE and 3% SDVE participation goals. The Contractor agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows: (OR)

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

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

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

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

ARTICLE 7. CONTRACT DOCUMENTS

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)
 - ix. Affidavit for Affirmative Action (Section 005414)
 - 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)
 - 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.

Further, if the Contractor provides any “personal information” as defined in §105.1500, RSMo concerning an entity exempt from federal income tax under Section 501(c) of the Internal Revenue Code of 1986, as amended, the Contractor understands and agrees that it is voluntarily choosing to enter into a state contract and providing such information for that purpose. The state will treat such personal information in accord with §105.1500, RSMo.

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

APPROVED:

 Brian Yansen, 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



STATE OF MISSOURI
 OFFICE OF ADMINISTRATION
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT FOR AFFIRMATIVE ACTION

PROJECT NUMBER

NAME

First being duly sworn on oath states: that

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

NAME

a sole proprietorship partnership
 limited liability company (LLC)

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

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

PROJECT TITLE

Less than 50 persons in the aggregate will be employed and therefore, the applicable Affirmative Action requirements as set forth in Article 1.4 of the General Conditions of the State of Missouri have been met.

PRINT NAME & SIGNATURE

DATE

--

NOTARY INFORMATION

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

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	DATE INSTALLED
LOCATION		

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



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 <input checked="" type="checkbox"/> 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
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	

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

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

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

B. The Contractor and his subcontractors shall develop, implement, maintain and submit in writing to the Owner an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed Affidavit for Affirmative Action

in the form included in the contract specifications. For the purpose of this section, an "affirmative action program" means positive action to influence all employment practices (including, but not limited to, recruiting, hiring, promoting and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between age 40 and 70), disabled and Vietnam-era veteran status, and disability. Such "affirmative action program" shall include:

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

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

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

ARTICLE 1.5 - ANTI-KICKBACK

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 place data, shop drawings and air and water balance reports.
4. Service Instructions: Provide the following information for all pieces of equipment.

- a. Recommended spare parts including catalog number and name of local supplier or factory representative.
- b. Belt sizes, types, and lengths.
- c. Wiring diagrams.

5. Manufacturer's Certificate of Warranty as described in Article 3.4.

6. Prior to the final payment, furnish to the Designer three (4) copies of parts catalogs for each piece of equipment furnished by him/her on the project with the components identified by number for replacement ordering.

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

1. Manuals shall be in quadruplicate, and all materials shall be bound into volumes of standard 8½" x 11" hard binders. Large drawings too bulky to be folded into 8½" x 11" shall be separately bound or folded and in envelopes, cross referenced and indexed with the manuals.

2. The manuals shall identify project name, project number, and include the name and address of the Contractor, subcontractors and manufacturers who were involved with the activity described in that particular manual.

3. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titles clearly printed under reinforced laminated plastic tabs.

4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.

ARTICLE 3.6 – OTHER CONTRACTOR RESPONSIBILITIES

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

and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him/her.

- C. The Contractor shall supply sufficient labor, material, plant and equipment and pay when due any laborer, subcontractor or supplier for supplies furnished and otherwise prosecute the work with diligence to prevent work stoppage and insure completion thereof within the time specified.
- D. The Contractor and each of his subcontractors shall submit to the Construction Representative, through the Designer such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.
- E. The Contractor, subcontractors, and material suppliers shall upon written request, give the Owner access to all time cards, material invoices, payrolls, estimates, profit and loss statements, and all other direct or indirect costs related to this work.
- F. The Contractor shall be responsible for laying out all contract work such as layout of architectural, structural, mechanical and electrical work, which shall be coordinated with layouts of subcontractors for general construction work. The Contractor is also responsible for unloading, uncrating and handling of all materials and equipment to be erected or placed by him/her, whether furnished by Contractor or others. No extra charges or compensation will be allowed as a result of failure to verify dimensions before ordering materials or fabricating items.
- G. The Contractor must notify the Construction Representative at least one working day before placing concrete or burying underground utilities, pipelines, etc.
- H. Contractors shall prearrange time with the Construction Representative for the interruption of any facility operation. Unless otherwise specified in these documents, all connections, alterations or relocations as well as all other portions of the work will be performed during normal working hours.
- I. The Contractor shall coordinate all work so there will not be prolonged interruptions of existing equipment operation. Any existing plumbing, heating, ventilating, air conditioning or electrical disconnections necessary for the project, which affect portions of this construction or building or any other building must be scheduled with the Construction Representative to minimize or avoid any disruption of facility operations. In no case,

unless previously approved in writing by the Construction Representative, shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities either intentionally or accidentally shall not relieve the Contractor responsible for the interruption from the responsibility to repair and restore the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

- J. Contractors shall limit operations and storage of materials to the area within the project, except as necessary to connect to existing utilities, and shall not encroach on neighboring property. The Contractor shall be responsible for repair of their damage to property on or off the project site occurring during construction of project. All such repairs shall be made to the satisfaction of the property owner.
- K. Unless otherwise permitted, all materials shall be new and both workmanship and materials shall be of the best quality.
- L. Unless otherwise provided and stipulated within these specifications, the Contractor shall furnish, construct, and/or install and pay for materials, devices, mechanisms, equipment, all necessary personnel, utilities including, but not limited to water, heat, light and electric power, transportation services, applicable taxes of every nature, and all other facilities necessary for the proper execution and completion of the work.
- M. Contractor shall carefully examine the plans and drawings and shall be responsible for the proper fitting of his material, equipment and apparatus into the building.
- N. The Contractor or subcontractors shall not overload, or permit others to overload, any part of any structure during the performance of this contract.
- O. All temporary shoring, bracing, etc., required for the removal of existing work and/or for the installation of new work shall be included in this contract. The Contractor shall make good, at no cost to the Owner, any damage caused by improper support or failure of shoring in any respect. Each Contractor shall be responsible for shoring required to protect his work or adjacent property and improvements of Owner and shall be responsible for shoring or for giving written notice to adjacent property owners. Shoring shall be removed only after completion of permanent supports.

- P. The Contractor shall provide at the proper time such material as is required for support of the work. If openings are required, whether shown on drawings or not, the Contractor shall see that they are properly constructed.
- Q. During the performance of work the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other devices appropriately located on site which will give proper and understandable warning to all persons of danger of entry onto land, structure or equipment.
- R. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials.
- S. The Contractor shall be responsible for care of the finished work and shall protect same from damage or defacement until substantial completion by the Owner. If the work is damaged by any cause, the Contractor shall immediately begin to make repairs in accordance with the drawings and specifications. Contractor shall be liable for all damage or loss unless attributable to the acts or omissions of the Owner or Designer. Any claim for reimbursement shall be submitted in accordance with Article 4. After substantial completion the Contractor will only be responsible for damage resulting from acts or omissions of the Contractor or subcontractors through final warranty.
- T. In the event the Contractor encounters an unforeseen hazardous material, the Contractor shall immediately stop work in the area affected and report the condition to the Owner and Designer in writing. The Contractor shall not be required, pursuant to Article 4, to perform, any work relating to hazardous materials.
- U. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 4.
- V. Before commencing work, Contractors shall confer with the Construction Representative and facility representative and review any facility rules and regulations which may affect the conduct of the work.
- W. Project signs will only be erected on major projects and only as described in the specifications. If no sign is specified, none shall be erected.

ARTICLE 3.7 -- SUBCONTRACTS

- A. Subcontractor assignments as identified in the bid form shall not be changed without written approval of the Owner. The Owner will not approve changes of a listed subcontractor unless the Contractor documents, to the satisfaction of the Owner that the subcontractor cannot or will not perform the work as specified.
- B. The Contractor is fully responsible to the Owner for the acts and omissions of all subcontractors and of persons either directly or indirectly employed by them.
- C. Every subcontractor shall be bound by the applicable terms and provisions of these contract documents, but no contractual relationship shall exist between any subcontractor and the Owner unless the right of the Contractor to proceed with the work is suspended or this contract is terminated as herein provided, and the Owner in writing elects to assume the subcontract.
- D. The Contractor shall upon receipt of "Notice to Proceed" and prior to submission of the first payment request, notify the Designer and Construction Representative in writing of the names of any subcontractors to be used in addition to those identified in the bid form and all major material suppliers proposed for all parts of the work.

ARTICLE 4 -- CHANGES IN THE WORK

4.1 CHANGES IN THE WORK

- A. The Construction Representative, without giving notice to the surety and without invalidating this contract, may order extra work or make changes by altering, adding to or deducting from the work, this contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract. A claim for extension of time caused by any change must be adjusted at the time of ordering such change. No future request for time will be considered.
- B. Each Contract Change shall include all costs required to perform the work including all labor, material, equipment, overheads and profit, delay, disruptions, or other miscellaneous expenses. No subsequent requests for additional compensation including claims for delay, disruption, or reduced efficiency as a result of each change will be considered. Values from the Schedule of Values will not be binding as a basis for additions to or deductions from the contract price.
- C. The amount of any adjustment in this contract price for authorized changes shall be agreed upon

before such changes become effective and shall be determined, through submission of a request for proposal, as follows:

1. By an acceptable fixed price proposal from the Contractor. Breakdowns shall include all takeoff sheets of each Contractor and subcontractor. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
2. By a cost-plus-fixed-fee (time and material) basis with maximum price, total cost not to exceed said maximum. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
3. By unit prices contained in Contractor's original bid form and incorporated in the construction contract.

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

1. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: incidental job burdens, small truck (under 1 ton) expense, mileage, small hand tools, warranty costs, company benefits and general office overhead. Project supervision including field supervision and job site office expense shall be considered a part of overhead and profit unless a compensable time extension is granted.
2. The percentages for overhead and profit charged on Contract Changes shall be 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 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.
 4. Written Affirmative Action Plans as required in Article 1.4.
- Above referenced items must be received by the Owner within ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.
- B. Within the time frame noted in Section 013200 - Schedules, following receipt of the "Notice to Proceed", the Contractor shall submit to the Owner a progress schedule and schedule of values, showing activities through the end of the contract period. Should the Contractor not receive written notification from the Owner of the disapproval of the schedule of values within fifteen (15) working days, the Contractor may consider it approved for purpose of determining when the first monthly Application and Certification for Payment may be submitted.
- C. The Contractor may commence work upon receipt of the Division of Facilities Management, Design and Construction's "Notice to Proceed" letter. Contractor shall prosecute the work with faithfulness and energy, and shall complete the entire work on or before the completion time stated in the contract documents or pay to the Owner the damages resulting from the failure to timely complete the work as set out within Article 5.4.

ARTICLE 5.2 -- PROJECT CONSTRUCTION

- A. Each Contractor shall submit for the Owner's approval, in reproducible form, a progress schedule showing the rate of progress and the order of the work proposed to carry on various phases of the project. The schedule shall be in conformance with the requirements outlined in Section 013200 – Schedules.
- B. Contractor shall employ and supply a sufficient force of workers, material, and equipment and shall pay when due, any worker, subcontractor or supplier and otherwise prosecute the work with such diligence so as to maintain the rate of progress indicated on the progress schedule, prevent work stoppage, and insure completion of the project within the time specified.

ARTICLE 5.3 -- PROJECT COMPLETION

- A. Substantial Completion. A Project is substantially complete when construction is essentially complete and work items remaining to be completed can be done without interfering with the Owner's ability to use the Project for its intended purpose.
 1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
 - a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
 - b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
 - c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working days notice before the inspection shall be performed.
 2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the

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

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

approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

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

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

- A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make payment within 30 calendar days after the

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

1. Updated construction schedule
 2. Certified payrolls consisting of name, occupation and craft, number of hours worked and actual wages paid for each individual employee, of the Contractor and all subcontractors working on the project
- B. The Owner shall retain 5 percent of the amount of each such payment application, except as allowed by Article 5.4, until final completion and acceptance of all work covered by this contract.
- C. Each payment made to Contractor shall be on account of the total amount payable to Contractor and all material and work covered by paid partial payment shall thereupon become the sole property of Owner. This provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work or as a waiver of the right of Owner to require fulfillment of all terms of this contract.
- D. Materials delivered to the work site and not incorporated in the work will be allowed in the Application and Certification for Payment on the basis of one hundred (100%) percent of value, subject to the 5% retainage providing that they are suitably stored on the site or in an approved warehouse in accordance with the following requirements:
1. Material has previously been approved through submittal and acceptance of shop drawings conforming to requirements of Article 3.2 of General Conditions.
 2. Delivery is made in accordance with the time frame on the approved schedule.
 3. Materials, equipment, etc., are properly stored and protected from damage and deterioration and remain so - if not, previously approved amounts will be deleted from subsequent pay applications.
 4. The payment request is accompanied by a breakdown identifying the material equipment, etc. in sufficient detail to establish quantity and value.
- E. The Contractor shall be allowed to include in the Application and Certification for Payment, one hundred (100%) of the value, subject to retainage,

of major equipment and material stored off the site if all of the following conditions are met:

1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.
 2. Materials stored in one location off site are valued in excess of \$25,000.
 3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.
 4. The materials are stored in a facility approved and inspected, by the Construction Representative.
 5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.
- F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.
- G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:
1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or items. The cost of corrective action(s) shall be borne by the Contractor.
 2. A reasonable doubt that this contract can be completed for the unpaid balance.
3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.
 4. Failure of the Contractor to update the construction schedule.
- When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.
- H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.
1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.
 2. The final payment shall not become due until the Contractor delivers to the Construction Representative:
 - a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from the Surety to final payment accepting liability for any unpaid amounts.

- b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor
 - c) Certified copies of all payrolls
 - d) As-built drawings
3. If any claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a claim including all costs and a reasonable attorney's fee.
 4. Missouri statute requires prompt payment from the Owner to the Contractor within thirty calendar days and from the Contractor to his subcontractors within fifteen calendar days. Failure to make payments within the required time frame entitles the receiving party to charge interest at the rate of one and one half percent per month calculated from the expiration of the statutory time period until paid.
 5. The value of all unused unit price allowances and/or 150% of the value of the outstanding work items, and/or liquidated damages may be deducted from the final pay request without executing a Contract Change. Any unit price items which exceed the number of units in the contract may be added by Contract Change.

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

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

ARTICLE 6.2 – INSURANCE

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

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

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

Business Automobile Liability Insurance, ISO Coverage form number or equivalent CA 00 01 covering automobile liability, code 1 "ANY AUTO".
 3. Workers' Compensation and Employer's Liability

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

Insurance upon the work and all materials, equipment, supplies, temporary structures and similar items which may be incident to the performance of the work and located at or adjacent to the site, against loss or damage from fire and such other casualties as are included in extended coverage in broad "All Risk" form, including coverage for Flood and Earthquake, in an amount not less than the replacement cost of the work or this 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:

Designer: Rick Wise
Clark & Enersen
2020 Baltimore Avenue
Kansas City, MO 64108
Telephone: 816-474-8237
Email: rick.wise@clarkenersen.com

MONG Project Manager /
Construction Representative: Billy Edwards
Missouri National Guard-CFMO Office
6819a North Boundary Road
Jefferson City, Missouri 65101
Telephone: 573-638-9534
Email: billy.j.edwards66.nfg@army.mil

Construction Representative: Ricky Howard
Division of Facilities Management, Design and Construction
836 North Scott
Belton, MO 64012
Telephone: 816-728-0385
Email: ricky.howard@oa.mo.gov

Project Manager: Sandra Walther
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: 573-257-7322
Email: sandra.walther@oa.mo.gov

Contract Specialist: April Howser
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: 573-751-0053
Email: april.howser@oa.mo.gov

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

4.0 FURNISHING CONSTRUCTION DOCUMENTS:

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

5.0 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.

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

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

- A. The Contractor is required to use only the designated site described in the Contract Documents. If another off-site area is proposed by the Contractor, the Contractor must provide written certification to the Division of Facilities Management, Design and Construction Project Representative that the proposed borrow or spoil site has been cleared of environmental concerns in accordance with all applicable Federal and State laws and regulations. These include but are not limited to the following: Clean Water Act; the Endangered Species Act; the National Historic Preservation Act (NHPA) (The site must have Section 106 Clearance); the Farmland Protection Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response; Compensation and Liability Act; and RSMo Chapter 194, Section 194.400, Unmarked Human Burial Sites. Certifications shall include clearance letters and other evidence of coordination with the appropriate regulatory agencies. The Missouri Historic Preservation Office, PO Box 176 Jefferson City, MO 65102, may be contacted to provide assistance with the NHPA and cultural resource issues pertaining to the borrow and spoil site regulations. The Missouri State Historic Preservation Office can provide a list of qualified and certified archaeologists to assist in borrow and spoil site investigations.
- B. If project conditions require off-site borrow or off-site deposit of spoils, the Contractor will be required to provide written certification to the Division of Facilities Management, Design and Construction Project Representative that the proposed borrow or spoil site has been cleared of environmental concerns in accordance with all applicable Federal and State laws and regulations. These include but are not limited to the following: Clean Water Act; the Endangered Species Act; the National Historic Preservation Act (NHPA) (The site must have Section 106 Clearance); the Farmland Protection Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response; Compensation and Liability Act; and RSMo Chapter 194, Section 194.400, Unmarked Human Burial Sites. Certifications shall include clearance letters and other evidence of coordination with the appropriate regulatory agencies. The Missouri Historic Preservation Office, PO Box 176 Jefferson City, MO 65102, may be contacted to provide assistance with the NHPA and cultural resource issues pertaining to the borrow and spoil site regulations. The Missouri State Historic Preservation Office can provide a list of qualified and certified archaeologists to assist in borrow and spoil site investigations.
- C. The Owner recognizes that additional time (beyond what is allowed in the Construction Contract) may be required in order to secure the aforementioned certifications and approvals. Should more time be required, the Owner will consider approval of a no-cost time extension contract change. The Contractor will be required to provide documentation that substantiates the need for the time extension.

**SECTION 007333 - 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.

- (5) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- (6) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- (7) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- (8) The Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. 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.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and sub contractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred

until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

8.0 Notice of Requirement for Affirmative Action To Ensure Equal Employment Opportunity
(Executive Order 11246, 41 C.F.R. 60-4.2)

(1) The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

(2) The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Time-tables	Goals for minority participation for each trade	Goals for female participation in each trade
105	10.0	6.9

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 C.F.R. pt. 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 C.F.R. 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 C.F.R. pt. 60-4. Compliance with the goals will be measured against the total work hours performed.

(3) The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

(4) As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is (insert description of the geographical areas where the contract is to be performed giving the state, county and city, if any).

9.0 Standard Federal Equal Employment Opportunity Construction Contract Specifications
(Executive Order 11246 - 41 C.F.R. 60-4.3)

(1) As used in these specifications:

a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;

c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

d. "Minority" includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

(ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

(3) If the Contractor is participating (pursuant to 41 C.F.R. 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

(4) The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the FEDERAL REGISTER in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement

contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

(5) Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

(6) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(7) The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other contractors and subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 C.F.R. pt. 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

(8) Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(9) A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

(10) The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, sexual orientation, gender identity, or national origin.

(11) The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

(12) The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

(13) The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 C.F.R. 60-4.8.

(14) The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily

understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

(15) Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

10.0 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.

11.0 Davis-Bacon Act (40 U.S.C. §§ 3141-3144, and §§ 3146-3148, and 29 C.F.R. pt. 5)

- (1) Minimum wages.
 - (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 C.F.R. pt. 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis–Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, That the employer's payroll records accurately set forth the time spent in

each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis–Bacon poster (WH–1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

- (ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:
- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
 - (2) The classification is utilized in the area by the construction industry; and
 - (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.
- (B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.
- (C) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.
- (D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.
- (iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.
- (iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis–Bacon Act

have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The (write in name of Federal Agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to Davis–Bacon prevailing wage requirements, which is held by the same prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis–Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 C.F.R. 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis–Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency). The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 C.F.R. 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime Contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered

worker, and shall provide them upon request to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency), the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime Contractor to require a subcontractor to provide addresses and social security numbers to the prime Contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 C.F.R. pt. 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 C.F.R. pt. 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 C.F.R. pt. 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The Contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the (write the name of the agency) or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, the Federal Agency may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 C.F.R. 5.12.

(4) Apprentices and trainees—

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship

Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a Contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

- (ii) Trainees. Except as provided in 29 C.F.R. 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

- (iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 C.F.R. pt. 30.
- (5) Compliance with Copeland Act requirements. The Contractor shall comply with the requirements of 29 C.F.R. pt. 3, which are incorporated by reference in this contract.
- (6) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 C.F.R. 5.5(a)(1) through (10) and such other clauses as the (write in the name of the Federal Agency) may by appropriate instructions require, 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 the contract clauses in 29 C.F.R. 5.5.
- (7) Contract termination: debarment. A breach of the contract clauses in 29 C.F.R. 5.5 may be grounds for termination of the contract, and for debarment as a Contractor and a subcontractor as provided in 29 C.F.R. 5.12.
- (8) Compliance with Davis–Bacon and Related Act requirements. All rulings and interpretations of the Davis–Bacon and Related Acts contained in 29 C.F.R. pts. 1, 3, and 5 are herein incorporated by reference in this contract.
- (9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 C.F.R. pt.s 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.
- (10) Certification of eligibility.
 - (i) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis–Bacon Act or 29 C.F.R. 5.12(a)(1).
 - (ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis–Bacon Act or 29 C.F.R. 5.12(a)(1).
 - (iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. § 1001.

11.0 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.

12.0 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.

13.0 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.

14.0 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.

15.0 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>.

16.0 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.

17.0 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.

18.0 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.

19.0 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.

20.0 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.).

21.0 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.

22.0 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.

23.0 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.

24.0 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.

25.0 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.

26.0 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.

27.0 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 55 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.

28.0 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



MICHAEL L. PARSON, Governor

Annual Wage Order No. 31

Section 051
JOHNSON 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 _____

Todd Smith, Director
Division of Labor Standards

Filed With Secretary of State: _____ **March 8, 2024**

Last Date Objections May Be Filed: **April 8, 2024**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$41.98
Boilermaker	\$25.75*
Bricklayer-Stone Mason	\$61.59
Carpenter	\$61.67
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$25.75*
Plasterer	
Communication Technician	\$25.75*
Electrician (Inside Wireman)	\$70.75
Electrician Outside Lineman	\$25.75*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$25.75*
Glazier	\$25.75*
Ironworker	\$68.78
Laborer	\$38.93
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$54.69
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$25.75*
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$25.75*
Plumber	\$78.74
Pipe Fitter	
Roofer	\$60.57
Sheet Metal Worker	\$76.10
Sprinkler Fitter	\$67.34
Truck Driver	\$25.75*
Truck Control Service Driver	
Group I	
Group II	
Group III	
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.

Heavy Construction Rates for
JOHNSON County

Section 051

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$64.53
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$25.75*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$51.91
General Laborer	
Skilled Laborer	
Operating Engineer	\$61.02
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$54.46
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

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

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

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

*The Division of Labor Standards received 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.

"General Decision Number: MO20240012 02/23/2024

Superseded General Decision Number: MO20230012

State: Missouri

Construction Type: Building

County: Johnson County in Missouri.

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

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	<ul style="list-style-type: none">. Executive Order 14026 generally applies to the contract.. The contractor must pay all covered workers at least \$17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	<ul style="list-style-type: none">. Executive Order 13658 generally applies to the contract.. The contractor must pay all covered workers at least \$12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be

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

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

Modification Number	Publication Date
0	01/05/2024
1	02/23/2024

* ASBE0027-004 10/01/2023

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 40.60	31.22

* BRM00003-005 06/01/2023

	Rates	Fringes
TILE SETTER.....	\$ 40.53	15.99

* BRM00015-010 04/01/2023

	Rates	Fringes
BRICKLAYER.....	\$ 39.85	21.70

CARP0005-014 05/01/2023

	Rates	Fringes
CARPENTER (Drywall Hanging, Form Work & Metal Stud Installation Only).....	\$ 40.71	20.15

ELEC0124-019 08/28/2023

	Rates	Fringes
ELECTRICIAN (including low voltage wiring for and installation of alarms).....	\$ 47.37	25.89

ELEV0012-001 01/01/2023

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 55.78	37.335+a+b

a. VACATION: Employer contributes 8% of basic hourly rate to vacation pay credit for employee who has worked in business more than 5 years and 6% for 6 months to 5 years as Vacation Pay Credit.

b. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Friday after Thanksgiving Day and Christmas Day.

ENGI0101-012 04/01/2020

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
Bulldozer.....	\$ 38.93	20.10
Grader/Blade.....	\$ 38.93	20.10
Loader.....	\$ 38.93	20.10
Roller.....	\$ 38.93	20.10

IRON0010-030 04/01/2023

	Rates	Fringes
IRONWORKER, REINFORCING AND STRUCTURAL.....	\$ 36.50	33.38

LAB00663-001 04/01/2023

	Rates	Fringes
LABORER		
Brick Mason Tender.....	\$ 26.43	14.15
Landscape.....	\$ 24.93	14.15

PAIN0003-018 04/01/2019

	Rates	Fringes
PAINTER		
Brush & Roller Only.....	\$ 30.54	17.76
Drywall Finishing/Taping Only.....	\$ 31.74	17.76

PLUM0008-001 06/01/2023

	Rates	Fringes
PLUMBER, Excludes HVAC Pipe Installation.....	\$ 54.28	23.79

PLUM0533-008 06/01/2023

	Rates	Fringes
PIPEFITTER, Includes HVAC Pipe Installation.....	\$ 53.56	24.70

ROOF0020-001 06/01/2023

	Rates	Fringes
ROOFER.....	\$ 37.60	21.64

SHEE0002-014 07/01/2023

	Rates	Fringes
SHEET METAL WORKER, Includes HVAC Duct and Unit Installation.....	\$ 50.43	26.96

* SUM02010-011 03/08/2010

	Rates	Fringes
CARPENTER, Excludes Drywall Hanging, Form Work, and Metal Stud Installation.....	\$ 23.33	7.42
CEMENT MASON/CONCRETE FINISHER...	\$ 17.95	6.64
GLAZIER.....	\$ 22.71	0.00
LABORER: Common or General.....	\$ 16.18 **	7.12
OPERATOR: Backhoe/Trackhoe.....	\$ 23.55	7.47
OPERATOR: Paver (Asphalt, Aggregate, and Concrete).....	\$ 24.47	0.00
OPERATOR: Water Truck.....	\$ 28.37	0.00
PAINTER: Spray.....	\$ 18.79	8.12

TRUCK DRIVER: Dump Truck.....\$ 28.92 0.00

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

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.20) or 13658 (\$12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

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

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

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical

order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

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

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

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

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

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the

classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

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

WAGE DETERMINATION APPEALS PROCESS

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

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

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

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

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

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

Wage and Hour Administrator

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

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

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

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

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

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END OF GENERAL DECISION"

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 Warrensburg Readiness Center, Renovation to Exterior/Interior
 1. Project Location: Warrensburg Readiness Center
343 E Gay St., Warrensburg, MO 64093
 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 **December 29, 2023**, 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 includes the renovation of two new sets of restrooms, a new kitchen design, a new floor to cover the existing stairs to the basement level, renovation to the existing supply office, and renovation to the workout space. Alternates include renovating the supply office, demolishing the west offices (3) and renovating the space to create a fitness room, replacing all interior doors and flooring in carpeted office spaces with LVT, resealing the drill hall, replacing existing blinds with aluminum commercial grade blinds, and replacing the caging adjacent to the supply office. See sheet G-001 for reference.
- D. The Work will be constructed under a single prime contract.

1.3 WORK SEQUENCE

- A. The Work will be conducted in one phase.

1.4 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 cause 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.

1.6 OWNER-FURNISHED PRODUCTS

- A. The Owner will furnish select restroom items including paper towel dispensers, ADA shower seats, shower curtain / rod, soap dispensers, and towel hooks. The owner is responsible for movable furniture in the cage storage as well as kitchen equipment (reference sheet FS-100). Pending alternate approval, the owner is responsible for furnishing the workout equipment room, including mat / flooring. 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 (Not Applicable)

END OF SECTION 011000

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 monthly on the number of “bad weather” days to be charged against the allowance. This determination will be documented in writing and be signed by the Contractor and the Construction Representatives. If there is a failure to agree on all or part of the “bad weather” days for a particular month, that disagreement shall be noted on this written document and signed by each party’s representative. Failure of the Contractor’s representative to sign the “bad weather” day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the “bad weather” day determination contained in that document.
- D. There will be no modification to the time of contract performance due solely to the failure to deplete the “bad weather” day allowance.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

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

END OF SECTION 012100

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

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

- 1. The cost for each alternate is the net addition to the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

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

1.4 PROCEDURES

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

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

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

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

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: *Renovate the Supply Office*

1. Description: Demolish the existing makeshift gyp walls in the Supply Office and replace with CMU walls. New door 033 to be added.
- B. Alternate No. 2: *Renovate the Fitness Area/Demo West Offices*
1. Description: Demolish the existing interior walls surrounding the west Offices 28, 29, and 30 (numbering per Clark & Enersen's plans). Repair floor as needed. New door 027 to be added. Workout equipment and mats / flooring to be provided by owner.
- C. Alternate No. 3: *Replacement – Doors, Flooring and Blinds; Reseal Drill Hall*
1. Description: Replace all interior doors and flooring in carpeted office spaces with LVT; this includes the front Offices (3), Honor Guard Offices (4), Break Room, Lobby, and Locker Room. Reseal the Drill Hall floor. Replace all existing blinds with aluminum commercial grade blinds.
- D. Alternate No. 4: *Replace Supply Room Caging*
1. Description: Demolish the existing caging in Supply Room area and replace with new caging. Owner to move and/or replace furniture in this space as needed.

END OF SECTION 012300

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 012600

SECTION 013100 – COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 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 "Schedules" 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 013100

SECTION 013115 - 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, E-Builder® 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 E-Builder® as provided by "e-Builder®" 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: E-Builder® 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 files, processes or design information distributed in this system is intended only for the project specified herein.
- D. Purpose: The intent of using E-Builder® 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 E-Builder 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 E-Builder® 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 E-Builder® web site by licensed users.

- a. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors 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 Sub Contractors 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 Sub Contractors 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 E-Builder® Documents area.

SECTION 013200 – SCHEDULE – BAR CHART

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 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 013200

SECTION 013300 – SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 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	Shop Drawings
02 41 19	Selective Demolition	Construction Schedule
02 82 13	Asbestos Abatement	Certification
02 82 13	Asbestos Abatement	Test Report
04 22 00	Concrete Unit Masonry	Product Data
06 10 00	Rough Carpentry	Product Data
06 10 00	Rough Carpentry	Test Report
06 40 23	Interior Architectural Woodwork	Product Data
06 40 23	Interior Architectural Woodwork	Test Report
07 92 00	Joint Sealants	Product Data
07 92 00	Joint Sealants	Sample
07 92 00	Joint Sealants	Test Report
07 92 00	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 71 00	Door Hardware	Product Data
08 71 00	Door Hardware	Test Report
08 71 00	Door Hardware	Warranty
08 80 00	Glazing	Product Data
08 80 00	Glazing	Sample

08 80 00	Glazing	Warranty
08 83 00	Mirrors	Product Data
08 83 00	Mirrors	Sample
08 83 00	Mirrors	Test Report
08 83 00	Mirrors	Warranty
09 22 16	Non-Structural Metal Framing	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 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	Test Report
09 67 13	Broadcast-Applied Decorative Flake Resinous Flooring	Operation / Maintenance Manual
09 91 23	Interior Painting	Product Data
09 91 23	Interior Painting	Sample
09 96 00	High-Performance Coatings	Product Data
09 96 00	High-Performance Coatings	Sample
09 96 13	Fiber-Reinforced Abrasion Resistant Coatings	Product Data
09 96 13	Fiber-Reinforced Abrasion Resistant Coatings	Sample
10 21 13	Metal Toilet Compartments	Product Data
10 21 13	Metal Toilet Compartments	Shop Drawings
10 21 13	Metal Toilet Compartments	Sample
10 21 13	Metal Toilet Compartments	Operation / Maintenance Manual
10 28 00	Toilet Accessories	Product Data
10 28 00	Toilet Accessories	Warranty
10 28 00	Toilet Accessories	Operation / Maintenance Manual
10 60 05	Wire Mesh Partitions	Product Data
11 05 12	General Motor Requirements for Equipment	Operation / Maintenance Manual
		Warranty
11 40 00	Food Service Equipment	Product Data
		Shop Drawings
		Operation / Maintenance Manual
		Warranty
11 40 11	Custom Fabricated Foodservice Equipment	Shop Drawings
		Operation / Maintenance Manual
		Warranty
11 41 00	Food Storage Equipment	Product Data
		Shop Drawings
		Warranty

11 41 21	Walk-In Coolers	Shop Drawings Operation / Maintenance Manual Warranty
11 41 33	Foodservice Shelving	Product Data Warranty
11 42 13	Food Preparation Appliances	Product Data Operation / Maintenance Manual Warranty
11 42 15	Tray Line and Service Equipment	Shop Drawings Operation / Maintenance Manual Warranty
11 43 13	Food and Ware Delivery Carts	Product Data Warranty
11 44 00	Food Cooking Equipment	Product Data Operation / Maintenance Manual Warranty
11 48 00	Cleaning and Disposal Equipment	Product Data Warranty
12 21 13	Horizontal Louver Blinds	Product Data
12 21 13	Horizontal Louver Blinds	Warranty
12 21 13	Horizontal Louver Blinds	Operation / Maintenance Manual
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 19	Plumbing Meters and Gauges	Product Data
22 05 29	Plumbing Hangers and Supports	Product Data
22 05 53	Plumbing Identification	Product Data
22 07 19	Plumbing Piping Insulation	Product Data
22 10 00	Plumbing Piping	Product Data
22 11 13	Facility Water Distribution Piping	Product Data
22 11 19	Plumbing Specialties	Product Data
22 11 19	Plumbing Specialties	Shop Drawings
22 30 00	Plumbing Equipment	Product Data
22 30 00	Plumbing Equipment	Shop Drawings
22 40 00	Plumbing Fixtures	Product Data
22 42 26	Commercial Disposers	Product Data Operation / Maintenance Manual Warranty
23 05 00	Basic HVAC Requirements	Shop Drawings
23 05 00	Basic HVAC Requirements	Product Data

23 05 13	Electrical Requirements for Mechanical	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 23 00	Refrigerant Piping and Specialties	Product Data
23 31 13	Ductwork	Shop Drawings
23 31 13	Ductwork	Product Data
23 33 00	Ductwork Accessories	Product Data
23 37 00	Air Outlets and Inlets	Product Data
23 38 13	Commercial Kitchen Hoods	Product Data
23 38 13	Commercial Kitchen Hoods	Shop Drawings
23 38 13	Commercial Kitchen Hoods	Test Report
23 51 00	Breechings, Chimneys and Stacks	Product Data
23 51 00	Breechings, Chimneys and Stacks	Shop Drawings
23 51 00	Breechings, Chimneys and Stacks	Warranty
23 54 00	Furnaces and Heat Pumps	Product Data
23 54 00	Furnaces and Heat Pumps	Shop Drawings
23 54 00	Furnaces and Heat Pumps	Test Report
23 72 00	Energy Recovery Ventilation Units	Product Data
23 72 00	Energy Recovery Ventilation Units	Shop Drawings
23 72 00	Energy Recovery Ventilation Units	Test Report
23 74 00	Make-Up Air Units	Product Data
23 74 00	Make-Up Air Units	Certification
26 05 00	Electrical General Provisions	Test Report
26 05 00	Electrical General Provisions	Operation / Maintenance Manual
26 05 00	Electrical General Provisions	Shop Drawings
26 05 01	Basic Materials and Methods	Shop Drawings
26 05 19	Conductors	Product Data
26 05 26	Grounding System	Product Data
26 05 26	Grounding System	Shop Drawings
26 05 33	Raceways	Product Data
26 22 00	Dry-Type Transformers	Shop Drawings
26 22 00	Dry-Type Transformers	Product Data
26 24 13	Switchboards	Product Data
26 24 13	Switchboards	Shop Drawings
26 24 16	Panelboards	Product Data
26 24 16	Panelboards	Shop Drawings
26 27 26	Wiring Devices	Product Data
26 29 13	Motor Controllers	Product Data
26 29 13	Motor Controllers	Shop Drawings
26 36 13	Manual Transfer Switch	Product Data
26 36 13	Manual Transfer Switch	Shop Drawings
26 51 00	Lighting	Product Data
26 51 00	Lighting	Shop Drawings
28 31 11	Fire Alarm System	Product Data

28 31 11	Fire Alarm System
31 10 00	Site Clearing
31 20 00	Earth Moving
32 92 00	Turf and Grasses

Shop Drawings
Shop Drawings
Shop Drawings
Product Data

END OF SECTION 013300

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 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 cards.

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 REQUIRED FINGERPRINTING FOR CRIMINAL BACKGROUND AND WARRANTS CHECK**
 1. All employees of the Contractor are required to submit fingerprints to the Missouri State Highway Patrol to enable the Office of Administration, Division of Facilities Management, Design and Construction (FMDC) to receive state and national criminal background checks on such employees. FMDC reserves the right to prohibit any employee of the Contractor from performing work in or on the premises of any facility owned, operated, or utilized by the State of Missouri for any reason.
 2. The Contractor shall ensure all of its employees submit fingerprints to the Missouri State Highway Patrol and pay for the cost of such background checks. The Contractor shall submit to FMDC via email to FMDCSecurity@oa.mo.gov a list of the names of the Contractor's employees who will be fingerprinted and a signed Missouri Applicant

Fingerprint Privacy Notice, Applicant Privacy Rights and Privacy Act Statement for each employee. All employees of the Contractor approved by FMDC to work at a State facility must obtain a contractor ID badge from FMDC prior to beginning work on-site, unless the Director of FMDC, at the Director's discretion, waives the requirement for a contractor ID badge. The Contractor and its employees must comply with the process for background checks and contractor ID badges found on FMDC's website at: <https://oa.mo.gov/fmdc-contractor-id-badges>.

3. Pursuant to section 43.540, RSMo, FMDC participates in the Missouri Rap Back and National Rap Back programs as of August 28, 2018. This means that the Missouri State Highway Patrol, Central Records Repository, and the Federal Bureau of Investigation will retain the fingerprints submitted by each of the Contractor's employees, and those fingerprints will be searched against other fingerprints on file, including latent fingerprints. While retained, an employee's fingerprints may continue to be compared against other fingerprints submitted or retained by the Federal Bureau of Investigation, including latent fingerprints.
4. As part of the Missouri and National Rap Back programs, FMDC will receive notification if a new arrest is reported for an employee whose fingerprints have been submitted for FMDC after August 28, 2018. If the employee is performing work on a State contract at the time of the arrest notification, FMDC will request and receive the employee's updated criminal history records. If the employee is no longer performing work on a State contract, FMDC will not obtain updated criminal records.
5. Pursuant to section 43.540, RSMo, the Missouri State Highway Patrol will provide the results of the employee's background check directly to FMDC. FMDC may NOT release the results of a background check to the Contractor or provide the Contractor any information obtained from a background check, either verbally or in writing. FMDC will notify the Contractor only whether an employee is approved to work on State property.
6. Each employee who submits fingerprints to the Missouri State Highway Patrol has a right to obtain a copy of the results of his or her background check. The employee may challenge the accuracy and completeness of the information contained in a background check report and obtain a determination from the Missouri State Highway Patrol and/or the FBI regarding the validity of such challenge prior to FMDC making a final decision about his or her eligibility to perform work under a State contract.
7. The Contractor shall notify FMDC via email to FMDCSecurity@oa.mo.gov if an employee is terminated or resigns from employment with the Contractor. If the Contractor does not anticipate performing work on a State contract in the future, the Contractor may request that FMDC remove its employees from the Rap Back programs. However, if removed from the Rap Back programs, employees will be required to submit new fingerprints should the contractor be awarded another State contract.
8. Upon award of a Contract, the Contractor should contact FMDC at FMDCSecurity@oa.mo.gov to determine if its employees need to provide a new background check. If a Contractor's employee has previously submitted a fingerprint background check to FMDC as part of the Missouri and National Rap Back programs, the employee may not need to submit another fingerprint search for a period of three to six years, depending upon the circumstances. The Contractor understands and agrees that FMDC may require more frequent background checks without providing any explanation

to the Contractor. The fact that an additional background check is requested by FMDC does not indicate that the employee has a criminal record.

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 01 50 00 – 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 Water Service: The Owner will provide water for construction purposes from the existing building system. All required temporary extensions shall be provided and removed by the Contractor. Connection points and methods of connection shall be designated and approved by the Construction Representative.
- C. Temporary Electric Power Service: 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.
- D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Heating: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
1. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP gas or fuel-oil heaters with individual space thermostatic control.
 2. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- F. Temporary 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.
- G. 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.
- H. 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.
- I. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.
1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45°F to 55°F (7°C to 13°C).
- J. excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip office as follows:
1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.
 2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.
- C. Storage Facilities: Limited areas for storage of building materials are available onsite. Available storage areas are shown on the drawings. The Contractor shall provide his own security. Specific locations for storage and craning operations will be discussed at the Pre-Bid Meeting and the Pre-Construction Meeting.
- D. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Designer.
1. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 2. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.

3. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
 4. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.
- E. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.
- F. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations 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.
- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.
 2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 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.
- H. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.
- I. 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.
- J. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
- K. 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.

- L. 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.
- M. 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. 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.
- C. 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.
- 3. 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.
- D. 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 01 50 00

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 impending drainage or traffic, and providing the required protection of materials.
 - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
 - 3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the jobsite.
 - 4. Provide adequate storage for all items awaiting removal from the jobsite, observing all requirements for fire protection and protection of the ecology.
- B. Site
 - 1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

2. Weekly, inspect all arrangements of materials stored onsite. Re-stack, tidy, or otherwise service all material arrangements.
3. Maintain the site in a neat and orderly condition at all times.

C. Structures

1. Daily, inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, sweep all interior spaces clean. "Clean" for the purposes of this 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" 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 02 82 13 - ASBESTOS ABATEMENT

PART 1 – GENERAL

1.1 SCOPE

- A. The Contractor shall inform themselves of the conditions for the project and is responsible for verifying the quantities and location of all work to be performed as outlined in this section. Failure to do so shall not relieve the Contractor of the obligation to furnish all materials and labor necessary to conduct the provisions of the Contract. The work of the Contract can be summarized in the following section. Compliance with all applicable Federal, State, and local regulations and the use of the best available technology, procedures, and methods for preparation, execution, cleanup, disposal, and safety are absolutely required. This compliance is the sole responsibility of the Contractor.

1.2 DESCRIPTION

- A. Furnish all labor, materials, services, insurance, and equipment in accordance with the most stringent requirements of EPA and OSHA and all other applicable regulatory agencies, to complete the removal of asbestos-containing materials as described in the Summary of Work.

1.3 BASE BID ITEMS

- A. The BASE BID will consist of the following items:
 - 1. Asbestos abatement of approximately 320 square feet of asbestos containing 12-inch by 12-inch floor tile and mastic located in Room 9 the kitchen.
 - 2. Asbestos abatement of approximately 11 asbestos containing mudded joint fittings located in Room 8 and the Drill Hall.
 - 3. Unit rate for additional floor tile and mastic abatement for asbestos floor tile on concrete flooring.
 - 4. Unit rate for additional mudded joint fittings.

1.4. TERMINOLOGY (Definitions)

- A. ABATEMENT: Procedure to control fiber release from asbestos containing building materials.

FOR THIS PROJECT:

- 1. REMOVAL - All herein specified procedures necessary to remove asbestos-containing materials from an area and dispose of the materials at an acceptable site in an acceptable manner.
- 2. POST-REMOVAL SURFACE ENCAPSULATION: Procedures necessary to coat surfaces from which asbestos-containing materials have been removed to control any residual fiber release.
- 3. AIR LOCK: A system for permitting ingress or egress without permitting air movement from a contaminated area into an uncontaminated area, typically consisting of two curtained doorways at least 3 feet apart.
- 4. AIR MONITORING: The process of measuring the fiber content of specific volume of air in a stated period of time. For this project, NIOSH Analytical Method 7400 "A" Counting Rules

- shall be used. When "aggressive" air sampling is specified, blowers/fans are used to dispense any remaining settled fibers into the air during final clearance sampling.
5. AMENDED WATER: Water to which a wetting agent or surfactant has been added to reduce water surface tension and thereby provide a more rapid saturation.
 6. AUTHORIZED VISITOR: The Owner Project Representative, his designee, or a representative of any regulatory or other agency having jurisdiction over the project.
 7. BUILDING OWNER: Missouri Army National Guard, or an authorized representative.
 8. CURTAINED DOORWAY: An assembly designed to allow ingress and egress from one room to another while permitting minimal air movement between the rooms. It is typically constructed by placing three overlapping sheets of opaque 6-mil polyethylene over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway, and securing the vertical edge of the other sheet along the opposite vertical side of the doorway.
 9. FULL STAGE DECONTAMINATION ENCLOSURE SYSTEM: A series of connected rooms with air locks between any two adjacent rooms, for the decontamination of workers and/or materials and equipment, constructed or moved onto site.
 10. DECONTAMINATION AREA: An area adjacent to work area, for the decontamination of workers and/or materials and equipment, constructed or moved onto site.
 11. EQUIPMENT DECONTAMINATION UNIT: Decontamination enclosure system for materials and equipment, typically consisting of a designated area of the work area (wash-down station), a washroom, a holding room, a container room, and an uncontaminated area.
 12. GROSS ABATEMENT AREA: An asbestos removal area that is sealed and fully contained in polyethylene sheeting. Workers enter the abatement area through a decontamination enclosure system.
 13. PERSONNEL DECONTAMINATION UNIT: A decontamination enclosure system for workers, typically consisting of a designated area of the work area (gross contaminant removal station), an airlock, an equipment room, an air lock, a shower, an air lock, and a clean room.
 - a. Equipment Room: A contaminated area or room in the personnel decontamination enclosure system with provisions for storage of contaminated clothing and equipment.
 - b. Shower Room: A room between the two air locks in the personnel decontamination enclosure system with hot and cold running water, soap and shampoo that is suitably arranged for complete showering during decontamination.
 - c. Clean Room: An uncontaminated area or room that is part of the worker decontamination unit with provisions for storage of workers' street clothes and protective equipment.
 14. FIXED OBJECT: A unit of equipment or furniture inside the work area that cannot be removed from the work area without dismantling.
 15. HEPA FILTER: A high efficiency particulate air (HEPA) filter capable of collecting and retaining 99.97% of monodispersed particles greater than or equal to 0.3 microns in diameter.
 16. HEPA VACUUM EQUIPMENT: High efficiency particulate air filtered vacuuming equipment with a filter system capable of collecting and retaining asbestos fibers. Filters should be of 99.97% efficiency for retaining monodispersed particles greater than or equal to 0.3 microns in diameter.
 17. NEGATIVE AIR PRESSURE EQUIPMENT: A local exhaust system, capable of maintaining a constant, low velocity air flow through the Decontamination Unit and into the Work Area from adjacent uncontaminated areas and exhausting that air outside the building through HEPA filters.
 18. NIOSH: National Institute for Occupational Safety and Health.
 19. ON-SITE REPRESENTATIVES: The Owner's full-time representative, responsible for air monitoring and enforcement of the specifications and the contractor's representative, responsible for full-time duties outside the containment.
 20. PLASTICIZING: Procedures necessary for an airtight seal, using polyethylene sheeting, adhesives, and/or taping.

21. POST REMOVAL ENCAPSULATION: A liquid material which can be applied to surfaces from which asbestos containing materials have been removed to control the possible release of residual asbestos fibers, either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components (penetrating encapsulant).
22. SURFACTANT: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.
23. WET CLEANING/WIPING: The process of eliminating contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as asbestos-contaminated waste.

1.4 EXISTING CONDITIONS

- A. It shall be the Contractor's responsibility to replace or repair to the Owner's satisfaction, prior to closeout of the project, all damaged items caused by the Contractor and not proven otherwise. All items damaged prior to abatement shall be noted during Design and Planning Meeting.
- B. Abatement contractor will be required to rewire/install lighting, thermostats and related wire that were removed during abatement.

PART 2 – EQUIPMENT AND MATERIALS

2.1. PERSONNEL PROTECTION REQUIREMENTS

- A. Prior to commencement of work, the workers shall be instructed and shall be knowledgeable on the hazards of asbestos exposure, use and fitting of respirators, protective clothing, decontamination procedures, and all aspects of asbestos work procedures. Workers shall have medical examinations.
- B. The Contractor is solely responsible for enforcing personnel protection requirements. These specifications provide only a minimum acceptable standard for each phase of operation.
 1. Provide workers with personally issued and marked respiratory equipment approved by NIOSH and accepted by OSHA. In lieu of a current negative exposure assessment (NAE), gross removal work to be performed in Type "C" respirators shall be pressure demand with full facepiece with a minimum protection factor of 1,000.
 2. Air supply for Type "C" shall be, at minimum, grade "D" in compliance with OSHA 1910.134. The Contractor shall provide sampling and testing of air in the presence of the Owners Representative when requested to do so.
 3. Air supply of Type "C" removal operations shall be a positive pressure, externally supplied, compressed air system, incorporating enough high-pressure automatic air storage within an ASME certified air "bank" to provide each individual on line in the work area with sufficient air supply for decontamination in the event of a system failure.
 - a. For this project, approved air systems are:
"E-Z Airline Supplied Air Respirator"
Scott Safety
4320 Goldmine Road
Monroe, NC 28110
or approved equivalent

- C. The compressed air system for removal workers shall incorporate a compressor failure alarm, high-temperature alarm, a continuous carbon-monoxide monitoring device, and in-line purifying sorbent beds and filters to deliver air free of water, oil, odors, vapors, and particulates. Contractor shall comply with all applicable codes and regulations that apply to the operation of such system.
- D. WHERE NOT IN VIOLATION OF NIOSH AND OSHA REQUIREMENTS, THE CONTRACTOR SHALL PROVIDE, AS A MINIMUM, THE FOLLOWING RESPIRATOR PROTECTION FOR EACH PHASE OF OPERATION:
1. Pre-cleaning/Wet Wiping of Area: NIOSH half-face dual cartridge respirators equipped with HEPA cartridges.
 2. Plastic Installation: NIOSH half-face dual cartridge respirators equipped with HEPA cartridges.
 3. Asbestos Removal and Cleanup: NIOSH powered air-purifying respirator (PAPR), Full-face equipped with HEPA cartridges.
 4. Asbestos Removal for Glove Bag, Flooring, Roofing Materials, and Debris Cleanup: NIOSH half-face dual cartridge respirators equipped with HEPA cartridges.
 5. Plastic Removal: NIOSH half-face dual cartridge respirators equipped with HEPA filters.
 6. Loading Waste Material on Truck (outside work area): NIOSH half-face dual cartridge respirators equipped with HEPA cartridges.
 7. Unloading Bags at Landfill: NIOSH half-face dual cartridge respirators equipped with HEPA cartridges.
- E. The above schedule is minimum respiratory protection acceptable. Should any condition, for any reason, be encountered where the exposure level, after application of the appropriate protection factor of the respiratory equipment in use, exceeds the Permissible Exposure Limit (PEL) of 0.1 f/cc, then the Contractor must substitute respiratory equipment with protection factors which reduce worker exposure levels below 0.1 f/cc. Should any such condition come to the Owner's Representative attention, the right is reserved to require the use of respiratory equipment with higher protection factors for any or all phases of the work.
- F. No visitors shall be allowed in work area, except as authorized by the Owners Representative. Provide authorized visitors with Powered Air Purifying Respirators with fresh cartridges or a Type "C" respirator, depending on phase of operation, whenever they are required to enter the work area, to a maximum of 4 per day.
- G. During Type "C" gross removal operations, one open airline shall be maintained at all times. Removal of a worker to provide this line will not be acceptable.
- H. Provide workers with sufficient sets of disposable protective full-body clothing. Such clothing shall consist of full-body coveralls, footwear, and headgear as manufactured by Kimberly Clark "Kleenguard", one-piece coveralls or equivalent.
- I. Provide eye protection and hard hats as required by applicable safety regulations. Reusable type protective clothing and footwear intended for reuse shall be left in the Equipment Room until the end of the asbestos abatement work at which time such items shall be disposed of as contaminated waste.
- J. Provide authorized visitors with suitable protective clothing, headgear, footwear, and gloves as described above whenever they are required to enter the work area.

PART 3 – EQUIPMENT & MATERIALS

3.1 MATERIALS

- A. Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.
- B. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.
- C. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Material that becomes contaminated with asbestos shall be disposed of in accordance with applicable regulations.
 - 1. **PLASTIC SHEETING:** A minimum of 2 layers of 6-mil for floor and two layers of 4-mil for walls, in sizes to minimize the frequency of joints.
 - 2. **TAPE:** Capable of sealing joints of adjacent sheets of polyethylene and for attachment of polyethylene sheets to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water, duct tape, poly prep tapes or approved equal.
 - 3. **ADHESIVES:** Capable of sealing joints of adjacent sheets of polyethylene and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water.
 - 4. **CAULKS:** As specified or approved.
 - 5. **SURFACTANT:** Use "Penewet" by Fiberlock Technologies, Andover, Maryland, or approved equal. Prior to bidding, the Contractor shall be responsible for verifying that this surfactant is compatible with the materials to be removed and their substrates. If found to be incompatible, the Contractor shall supply suitable wetting agents at no extra cost to the Owner.
 - 6. **IMPERMEABLE CONTAINERS:** Suitable to receive and retain any asbestos-containing or contaminated materials until disposal at an approved site. The containers shall be labeled in accordance with OSHA Regulation 29 CFR 1926.1101 and NESHAP's. Containers must be both air and watertight and must be resistant to damage and rupture. The containers shall be a pair of 6-mil polyethylene bags. Oversized or irregularly shaped waste material shall be wrapped in two layers of polyethylene sheeting, taped and labeled.
 - 7. **WARNING LABELS AND SIGNS:** As required by OSHA regulation 29 CFR 1926.1101 and NESHAP Title 40 Part 61.
 - 8. **GLOVE BAGS:** "Avail" by Grayling Industries or approved equal.
 - 9. **MASTIC REMOVAL SOLVENT:** Solvent capable of removing mastic using hand pressure accompanied by hand tools. Solvent must not meet EPA's characteristics of hazardous waste and must be of low odor. Safety Data Sheets (SDSs) must be available on demand.
 - 10. **OTHER MATERIALS:** Provide all other materials, such as, but not limited to lumber, plywood, nails, and hardware, which may be required to properly prepare and complete the project.

3.2 TOOLS AND EQUIPMENT

- A. Provide suitable tools for asbestos removal.
- B. **Water Sprayer:** Airless or a low-pressure sprayer for amended water application as applicable.
- C. **Air-Purifying Equipment:** High Efficiency Particulate Air Filtration Systems (HEPA) shall comply with ANSI Z9.2-79. No air movement system or air equipment should discharge asbestos fibers outside the work area. Thus, the negative air unit shall be equipped with a three-filter bank with the last being the HEPA filter capable of removing 99.97% of monodispersed particles greater than or equal to 0.3 microns in diameter or larger.

- D. Paint/Encapsulant Sprayer: Airless.
- E. Scaffolding: As required to accomplish the specified work and meet all applicable safety regulations.
- F. Vacuums: Use HEPA type such as Nilfisk GD930, or approved equal.
- G. Other tools and equipment as necessary.

PART 4 – EXECUTION OF ABATEMENT

4.1 POSTING OF THE PROJECT

- A. Post caution signs in and around the work area to comply with OSHA regulation 29 CFR 1926.1101 and in compliance with all other Federal, State, and Local requirements.

4.2 WORK AREA PREPARATION

- A. The Contractor, in coordination with the Owner, shall shut down or isolate heating, cooling, and ventilating air systems to the work areas.
- B. Remove all removable items and equipment from the work areas prior to the beginning of work by the contractor.

4.3 WORK AREAS - WORK BY CONTRACTOR

- A. **FULL ENCLOSURE:** for gross abatement of friable asbestos-containing materials.
 - 1. Preclean fixed objects within the work area, first using HEPA vacuum equipment and then wet cleaning methods as appropriate, and completely enclose with minimum 6-mil thick plastic sheeting sealed with tape.
 - 2. Clean the work area first using HEPA vacuum equipment and then wet cleaning methods as appropriate. Do not use methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not use HEPA vacuum equipment on wet surfaces unless units are specially constructed for wet/dry use.
 - 3. Seal off all critical barriers, including but not limited to windows, corridors, doorways, skylights, ducts, grilles, diffusers, and any other penetrations of the work areas, with 6-mil plastic sheeting sealed with tape. Open doorways and corridors with direct access to occupied areas shall be sealed with double barriers as described in paragraph 3.5 of this section. These critical barriers shall remain in place until demolition.
 - 4. Cover floor first (except for floor covering removal) and then wall surfaces with plastic sheeting completely sealed with tape at all edges and with adhesive and tape at all joints. Use a minimum of two layers of 6-mil plastic on floors (except for floor covering removal) and all fixed horizontal surfaces. Cover floors first so that plastic extends at least 12 inches up on walls, then cover walls with a layer of 4-mil thick plastic sheeting to the floor level, thus overlapping the floor material by a minimum of 12 inches. The Contractor shall assume responsibility for all damage to carpet, floor tile, hard wood, or other flooring that occurs during the construction period.

5. Build full stage decontamination units (defined in 3.4 of this section) at one entrance to the work area.
- B. FULL ENCLOSURE: for gross abatement of non-friable asbestos-containing materials not considered to be small-scale short duration abatement.
1. Preclean fixed objects within the work area, first using HEPA vacuum equipment and then wet cleaning methods as appropriate, and cover with plastic sheeting.
 2. Clean the work area first using HEPA vacuum equipment and then wet cleaning methods as appropriate. Do not use methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not use HEPA vacuum equipment on wet surfaces unless units are specially constructed for wet/dry use.
 3. Seal off all openings, including but not limited to windows, corridors, doorways, skylights, ducts, grilles, diffusers, and any other penetrations of the work areas, with 6-mil plastic sheeting sealed with tape. Open doorways and corridors with direct access to occupied areas shall be sealed with double barriers as described in paragraph 3.5 of this section. These critical barriers shall remain in place until demolition.
 4. To meet regulations, build full stage decontamination units or set up a decontamination area at entrances to and exits from the work areas as defined in 3.4 of this section.
- C. MINI CONTAINMENT: for the gross abatement of small quantities of friable asbestos-containing materials and glovebag operations.
1. Use a minimum of two layers of 6-mil plastic sheeting to construct wall and ceiling surfaces. Cover floors with two layers of 6-mil plastic sheeting (except for floor covering removal), completely seal all edges and joints with adhesive and tape. These critical barriers shall remain in place until completion.
 2. Triple flap entrance to and from work area.
 3. Set up a decontamination area (defined in 3.4 of this section) at entrance to and from the work area.
- D. Prior to commencing abatement work, shut down and isolate heating, cooling, and ventilating air systems (HVAC) to prevent contamination and fiber dispersal to other areas of the building. Seal vents within the work area with tape and 6-mil plastic sheeting.
- E. Set up and start negative air pressure as defined by 4.11.
- F. Maintain and mark emergency exits from the work areas or establish alternate exits satisfactory to the owner and local fire department.
- G. Outside areas, friable glovebag removals of three square/linear feet or less, dismantling, and non-friable small-scale short duration abatement areas shall be cordoned off with barrier tape and appropriate warning signs posted. A decontamination area (defined in 3.4 of this section) shall be set up at the entrance to and from the work area.

4.4 DECONTAMINATION ENCLOSURE SYSTEMS

- A. GENERAL: For gross abatement of friable asbestos-containing materials, the Contractor shall use prefabricated portable decontamination units acceptable to EPA and OSHA that are connected to the work area with framed-in or accordion style tunnels, lined with plastic and sealed with tape at all joints in the plastic, or construct custom decontamination units once on-site.
- B. ACCESS: In all cases, access between contaminated rooms or areas shall be through an air lock. In all cases, access between any two rooms within the decontamination enclosure systems shall be through an air lock.

- C. FULL STAGE DECONTAMINATION ENCLOSURE SYSTEM: Construct a worker decontamination enclosure system contiguous to the work area consisting of three totally enclosed chambers as follows:
1. An equipment room with two curtained doorways, one to the work area and one to the shower room.
 2. A shower room with two curtained doorways, one to the equipment room and one to the cleanroom. The shower room shall contain at least one shower with hot and cold or warm water with individual shut-off valves and backflow check valves inside the showers. Careful attention shall be paid to the shower enclosure to insure against leakage of any kind. Ensure a supply of soap at all times in the shower room. Drainage from showers shall be disposed of as contaminated water or filtered as specified below.
 3. Wastewater containing asbestos, including drainage from decontamination showers, shall be either disposed of as contaminated waste or filtered in accordance with the following requirements prior to introduction into the sanitary sewer system.
 - a. Filter water using three in-line filter cartridges with 2" inlets and outlets. The outlet of each filter cartridge shall be connected in series to the inlet of the next cartridge. The first cartridge shall contain 100-micron prefilters and the second and third cartridge shall contain 25-micron filters and the final cartridge shall contain 5-micron filters.
 - b. Spare filters of three sizes shall be maintained at the site at all times to replace prefilters during cleaning.
 - c. When the prefilters become clogged replace with spares, dispose of accumulated debris as contaminated waste, and wash out the prefilters in the shower, allowing the drainage from the cleaning operation to go through the filtration system.
 - d. When the final filters become clogged, remove the filters, replace with new and dispose of the clogged filters as contaminated waste.
 - e. Provide a holding tank for contaminated wastewater as required to prevent backup of water into shower when the amount of water generated exceeds the flow rate of the filters.
 - f. Hoses will be equipped with backflow check valves
 - g. A clean room with one curtained doorway in to the shower and one entrance or exit to non-contaminated areas of the building. The clean room shall have sufficient space for storage of the workers' street clothes, towels, and other non-contaminated items.
 - h. If decontamination unit is outside, cover in 1/2" plywood and have a securable door.
 - i. The contractor is required to practice appropriate housekeeping of the decontamination unit at all times, keeping it free of accumulated waste and debris.
- D. EQUIPMENT DECONTAMINATION ENCLOSURE SYSTEM: Provide or construct an equipment decontamination enclosure system consisting of two totally enclosed chambers as follows: 4.4.4.1. A washroom, constituting an air lock, with a curtain doorway to a designated area of the work area and a curtained doorway to the holding area.
1. A holding area, constituting an air lock, with a curtained doorway to the washroom and a curtained doorway to the uncontaminated area.
 2. Contractor may elect to construct equipment decontamination unit on side of equipment room of worker decontamination unit.
 3. If equipment decontamination unit is outside, cover in 1/2" plywood and have a securable door.
- E. Small-scale short duration projects, dismantling, glovebag removals, and non-friable abatements do not require a full three stage decontamination unit. The decontamination unit shall meet regulations.
1. The Contractor shall establish a decontamination area that is adjacent to the regulated area for decontamination of employees and their equipment. Use of portable

decontamination units acceptable to EPA and OSHA may be used. At a minimum the decontamination shall consist of an area covered by an impermeable drop cloth on the floor or horizontal-working surface of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination.

2. A HEPA equipped vacuum shall be used to clean debris from protective clothing.
3. Water sprayers will be available for workers to clean with.
4. Entry to and exit from the regulated area shall be through the decontamination area.

4.5 SEPARATION OF WORK AREAS FROM NON-WORK AREAS

- A. The work areas are to be separated from non-work areas by temporary barriers. The barriers are to meet regulation requirements for the asbestos containing materials being abated. Small-scale short duration projects, dismantling, and minor glovebag operations require a minimum of barrier tape separating the work area from the non-work area.
- B. FULL ENCLOSURE: for gross abatement of friable asbestos-containing materials.
 1. Temporary barriers for corridors, doorways, and cased openings not to be used for passage shall be sealed with wood or metal studs, 16" o.c., faced with 3/8" plywood sheathing on the work area side only. Edges of the partition at floors, walls, and ceilings shall be caulked airtight. Cover both sides of the partition with 2 layers of 6-mil polyethylene sheeting. Tape and caulk as required to provide an airtight seal.
 2. Separation of work areas, adjacent to occupied areas shall require a second outer barrier, framed as described above, and covered with two layers of polyethylene. These barriers shall be separated by a minimum of 6 feet. Provide a curtained doorway in the outer partition for access for air monitoring purposes.
 3. Visual separation shall be accomplished at all "see-through" locations using opaque polyethylene. This separation shall not be incorporated within the other seals involved on this project.
 4. Not less than one temporary partition or seal shall contain a clear viewing area that is 18 inches or more in height and width and installed in a manner that will allow direct visual observation of the work area from a location outside of the work area.
- C. FULL ENCLOSURE: for gross abatement of non-friable asbestos-containing materials not considered to be small-scale short duration abatement.
 1. Temporary barriers shall seal off all openings, including but not limited to windows, corridors, doorways, skylights, ducts, grilles, diffusers, and any other penetrations of the work areas, with 6-mil plastic sheeting sealed with tape. Open doorways and corridors with direct access to occupied areas shall be sealed with double barriers. These critical barriers shall remain in place until after the area is deemed free of asbestos contaminates.
- D. MINI CONTAINMENT: for the gross abatement of small quantities of friable asbestos-containing materials and glovebag operations over 3 linear feet.
 1. Temporary barriers shall be a minimum of two layers of 6-mil plastic sheeting constructed to create walls, ceiling, and floor (except for floor covering removal), completely sealed with adhesive and tape at all edges and joints. These critical barriers shall remain in place until after the area is deemed free of asbestos contaminates.

- E. During outside work, close or cover with six-mil plastic sheeting all exterior openings, to the interior of the building, within 50 feet of work area on exterior of building.
- F. At the beginning of each work shift and throughout removal, all seals and critical barriers shall be inspected, and if not found in proper condition, repaired immediately.

4.6 MAINTENANCE OF DECONTAMINATION ENCLOSURES

A. FULL STAGE DECONTAMINATION ENCLOSURE SYSTEM

1. At the beginning of each work shift and throughout removal, all seals and curtained doorways shall be inspected, and if not found in proper condition, repaired immediately.
2. Soap and shampoo shall be in the showers at all times.
3. Fresh towels shall be available at all times.
4. Provide storage for wet and dry towels.
5. Ensure that the drainage filtering systems are kept clean and operable at all times.
6. At the end of each decontamination period, the shower, air locks, and clean room shall be cleaned and dried.
7. At the end of each work shift: Thoroughly disinfected; the filter bag (if applicable) shall be returned to the equipment room and first air lock shall be thoroughly HEPA vacuumed and wet cleaned.

B. Respiratory equipment shall be cleaned, repaired, and sanitized after each use.

C. Provide a disposal bag for contaminated filters.

D. All areas shall be kept clean and in order.

E. DECONTAMINATION AREA

1. At the end of each work shift: Thoroughly disinfected, HEPA vacuumed, and wet cleaned. All debris and rubbish shall be removed, bagged, and disposed of as asbestos-containing materials.

4.7 WORKER PROTECTION - TO BE POSTED IN CLEAN AND EQUIPMENT ROOMS

A. All workers and authorized personnel, in order to enter the work area, shall:

1. Full enclosure with gross removal of friable material: Remove all clothing, unless it is to remain in the equipment room for eventual disposal.
2. Don appropriate protective clothing (coveralls, gloves, boots, etc.) before entering work area.
3. Don the appropriate respiratory protection, following all training procedures and manufacturer's instructions. Hood shall be worn over respirator straps.
4. When in Type "C" equipment, once all of the above has been done, proceed to the shower. Reach into the air lock and obtain an air line from the hose rack. Plug in and check the equipment before proceeding any further.

B. FULL ENCLOSURE with gross removal of friable material: all workers and authorized personnel, in order to leave the work area, shall:

1. Remove gross (visible) contamination from themselves and their equipment.

2. Enter the equipment room and, keeping respirator in place, remove all protective clothing, including gloves and boots. Place contaminated clothing in the bag(s) provided. Store gloves and/or boots in their respective areas.
 3. Still wearing the respirator, proceed to the first air lock. Once inside, ensure all curtained doorways behind are properly closed.
 4. Respirator still in place, move into the shower room and rinse off thoroughly. If wearing dual cartridge respirators, make sure the cartridges are completely soaked before removing the respirator and disposing of cartridges in the container provided.
 5. If wearing Type "C" respirators, rinse off approximately 3' - 4' on airline, upper body and the respirator. Once complete; return the airline to the hose rack inside the air lock.
 6. Pass respirators into the second air lock (between shower and the clean room).
 7. Complete showering, thoroughly soaping, and shampooing.
 8. Proceed to the clean room, dry off, dress, and return respirator to the storage area.
 9. No smoking, eating, or drinking shall be allowed inside decontamination enclosures.
- C. Small-scale short duration projects, dismantling, glovebag operations and outside work, all workers and authorized personnel, in order to leave the work area, shall:
1. Remove gross (visible) contamination from themselves and their equipment. Work clothes must be cleaned with a HEPA vacuum before clothes are removed.
 2. All equipment and surfaces of containers filled with ACM must be cleaned prior to removing them from the work area.

4.8 COMMUNICATIONS

- A. Provide an electronic communications system suitable for inside or outside, and inter-room communications, in order to monitor all activities within the work area and to readily transfer messages from one location to another.

4.9 FIRE EXITS

- A. Designate and maintain emergency and fire exits from the work area in accordance with local codes and regulation. All exits shall be clearly marked with fluorescent tape or red enamel and shall be clearly visible from any part of the work area.

4.10 SECURITY

- A. Make all necessary provisions for building security (for the duration of each project) for areas designated for this project.

4.11 LOCATION AND ACTIVATION OF NEGATIVE AIR PRESSURE

- A. FULL ENCLOSURE: for gross abatement of friable and non-friable asbestos-containing materials.
- B. Comply with paragraph J.2 of the EPA document, Guidance of Controlling Friable Asbestos-Containing Materials in Buildings, June 1985.
- C. Provide one spare exhaust unit per three sites at all times. Spare exhaust units shall be of the same size and capacity as the largest operating units.

- D. Suspend electrical cords off the floor and out of workers' way to protect the cords from damage from traffic, sharp objects, and pinching. Do not fasten cords with staples, and do not hang cords from nails or suspend with wire.
- E. Provide number of exhaust units in each work area to provide at least one air change every 15 minutes in all locations of the work areas. Negative air units are assumed to draw 80% of their rated capacity. If it can be proven to the Project Representative that the units draw over 80% of their rated capacity, the calculated exchange rate may be altered.
- F. Locate units so that make-up air enters the work area primarily through the decontamination facility and transverses the work area as much as possible. Use Section J.3 of the referenced standard as a guide.
- G. Provide additional make-up air openings as shall be necessary to effectively move air through the work area and to avoid creating too high a pressure differential that would damage or cause collapse of temporary barriers and plastic coverings. Provide inlets by making openings in the plastic sheeting near the ceiling and as far as possible from the exhaust units. Provide self-closing polyethylene flaps over the openings to prevent backflow of air from the contained area to the outside.
- H. Provide minimum number of auxiliary make-up air openings to maintain negative pressure. A negative pressure differential of at least 0.02 inches of water shall be maintained at all times.
- I. Vent all exhaust units to the outside of the building. Provide flexible or rigid duct as necessary to provide exterior venting and proper location of exhaust units. Ducts shall be completely sealed, in good repair, and protected from possible damage within the work area.
- J. After the work area has been prepared, the decontamination facility set up, and the exhaust units installed, start the units (one at a time if more than one is provided). Visually check the direction of air movement through the openings in the barriers, and verify movement of air in all location of the work areas by use of ventilation smoke tubes. Adjust the location of exhaust units, or provide additional exhaust units for the work area if the test indicates inadequate or improper air movement.
- K. After removal has begun, maintain operation of exhaust units continuously to maintain a constant negative pressure until decontamination of the work area is complete. Do not turn units off at the end of the work shift or when removal operations temporarily stop.
- L. When a final inspection and the results of the final air monitoring tests indicate an acceptable level of airborne fibers, remove and dispose of prefilters and shut off the exhaust units. If the exhaust units are to be used in another work area, leave the final filter in place and seal all intake openings to the unit to prevent contamination due to asbestos fibers collected on the final filter. If the exhaust units are not to be used in other work areas, remove the final filter and dispose of as contaminated waste.
- M. Change filters in exhaust units in accordance with manufacturer's recommendations and Paragraph J.3.2.2.1. of the reference standard or when there is obvious loss of negative pressure.
- N. If dismantling of exhaust units results in visible dust on surfaces, replace filters, restart exhaust units, reclean surfaces and perform additional area air monitoring (at Contractor's expense) until the level of airborne fibers is acceptable as specified.
- O. Dispose of all filters as asbestos-contaminated waste material as specified.

4.12 MINI CONTAINMENT

- A. A HEPA vacuum may be used in place of an exhaust unit based on the size of containment and the amount of negative pressure produced.

4.13 GLOVEBAG

- A. A HEPA vacuum shall be used to create negative pressure.

4.14 EQUIPMENT REMOVAL PROCEDURES

- A. Clean external and internal surfaces of all non-fixed equipment and/or objects, prior to starting gross removal, by thoroughly wet wiping and/or rinsing, before moving such items into the Equipment Decontamination Unit for final cleaning and removal to uncontaminated areas.
- B. Objects and equipment removed shall be stored in areas designated by the Owner.

4.15 PREWORK INSPECTIONS

- A. Upon completion of all work area preparation and immediately before work is to begin, notify on-site representative that the work area is ready for inspection.
- B. The Contractor shall not begin abatement work until the on-site representative has inspected the area and any deficiencies have been corrected.

4.16 GROSS REMOVAL

- A. FULL ENCLOSURE: for gross abatement of friable asbestos-containing materials. Related Sections: 02 82 13.19 - 4.3 (Work Areas), 4.4 (Decontamination Enclosure Systems), 4.5 (Separation of Work Areas), 4.6 (Maintenance of Decontamination Unit), 4.7 (Worker Protection), 4.8 (Communication), 4.9 (Fire Exits), 4.10 (Security), 4.11 (Location and Activation of Negative Air Units), 4.12 (Equipment Removal), and 4.13 (Pre-work Inspection).
 - 1. Any housing grills, vents, or penetrations concealing asbestos-containing materials shall be lowered and/or removed and protected to provide access to the materials. Replacement or reattachment of these shall be in a manner such that function and appearance is equal to or exceeds the original condition.
 - 2. All fixtures, grills, clocks, intercom systems, and any other metal objects shall be protected from amended water. Surfactant will cause oxidation. Painted surfaces shall also be protected. Gauges or other items susceptible to rust shall be cleaned with an acceptable substitute such as isopropyl alcohol.
 - 3. Spray asbestos-containing material with amended water, using spray equipment capable of providing a "mist" application to reduce the release of fibers. Saturate the material sufficiently to wet it to the substrate without causing excessive dripping. The use of high RPM power equipment, pressure washers, or hydroblasters shall not be acceptable without special permission from the Owners Representative. Remove the saturated asbestos material in small sections from all areas. Material drop shall not exceed fifteen feet (15'). For heights up to fifty feet (50'), provide inclined chutes to intercept drop. For heights exceeding fifty feet (50') provide enclosed, dust proof chutes. Material shall not be allowed to dry before placing in sealable polyethylene bags of 6-mil minimum thickness. All asbestos-containing material shall be removed thoroughly and totally. Nylon fiber brushes shall be used to clean asbestos

- fibers from rough surfaces. Any contaminated material capable of puncturing the polyethylene shall be packaged separately.
4. FULL ENCLOSURE: for gross abatement of non-friable asbestos-containing materials not considered to be small-scale short duration. Related Sections: 02 82 13.19 - 4.3 (Work Areas), 4.4 (Decontamination Enclosure Systems), 4.5 (Separation of Work Areas), 4.6 (Maintenance of Decontamination Unit), 4.7 (Worker Protection), 4.8 (Communication), 4.9 (Fire Exits), 4.10 (Security), 4.11 (Location and Activation of Negative Air Units), 4.12 (Equipment Removal), and 4.13 (Pre-work Inspection).
 5. MINI CONTAINMENT: for gross abatement of friable asbestos-containing materials considered to be small-scale short duration. Related Sections: 02 82 13.19 - 4.3 (Work Areas), 4.4 (Decontamination Enclosure Systems), 4.5 (Separation of Work Areas), 4.6 (Maintenance of Decontamination Unit), 4.7 (Worker Protection), 4.8 (Communication), 4.9 (Fire Exits), 4.10 (Security), 4.11 (Location and Activation of Negative Air Units), 4.12 (Equipment Removal), and 4.13 (Pre-work Inspection). Maintain work areas free to accumulated asbestos-containing materials at all times. Keep waste materials wet until enclosed in sealed plastic bags.
 6. Seal polyethylene bags airtight. Ensure that all contaminated materials are double bagged to yield a minimum covering of 12 mil before removed from the work area. Move the bagged material to the wash-down station adjacent to the equipment decontamination enclosure. Once inside the washroom, the bags shall be wet cleaned or HEPA vacuumed and passed into the holding room. Single bagged material shall be placed in a clean bag or into a lined drum. At no time shall a removal worker pass the curtained doorway between the holding room and the container room.
 7. Once the removal has been completed, the Contractor is to notify Consultant that the area is ready for visual inspection. Once it has been determined that no visible debris remains Consultant will initiate aggressive final air sampling. Consultant will provide final air sampling results to the Contractor and the Owner.
 8. If testing results indicate fiber levels not acceptable by AHERA standards, the work area shall remain sealed until an acceptable concentration is obtained.

4.17 GLOVE BAGS

- A. All glove bag work specified under this section shall be performed in compliance with OSHA regulation 29 CFR 1926.1101.
- B. Related Sections: 02 82 13.19 - 4.3 (Work Areas), 4.4 (Decontamination Enclosure Systems), 4.5 (Separation of Work Areas), 4.6 (Maintenance of Decontamination Unit), 4.7 (Worker Protection), 4.8 (Communication), 4.9 (Fire Exits), 4.10 (Security), and 4.13 (Pre-work Inspection).
- C. Any further use of glovebags other than what is listed in the Summary of Work Section will be made during the Design and Planning Meeting.
- D. The Contractor shall be required to arrange equipment to protect it with polyethylene sheeting. The Contractor shall build a mini containment or rope off an area at least twenty-five feet (25') on all sides of glove bag work location to restrict personnel movement during the removal (4.3 and 4.5 of this section) process and post the proper caution signs. The requirement is based on occupancy, location of the abatement activity, and quantity to be removed; a decision will be made during the Design and Planning Meeting.
- E. Pre-clean and protect floors, walls, and surrounding area as necessary, within the work area with 6-mil polyethylene sheeting, tape and/or adhesives. As a minimum, extend polyethylene one foot horizontally in all directions for each vertical foot from floor to material height.
- F. FULL ENCLOSURES or MINI CONTAINMENTS: For Large-scale glovebag removals or if excessive friable debris is present.

1. Establish air filtration equipment, exhausted outside the building as stated in 3.11.
 2. Seal all opening, doors, vents, windows, and other penetrations of the work area with 6-mil polyethylene sheeting.
 3. If fiber levels found on the personal samples during glove bag removal exceed 0.01 f/cc and methods to reduce the excess prove futile, the Contractor shall remove the insulation under "gross removal" conditions with full plastic sheeting, decontamination unit, negative air filtration, etc. at the discretion of the Consultant.
- G. Using approved glovebags in strict accordance with the manufacturer's instructions, workers in full protective body clothing and respirators in accordance with Section 2.1.7.4 of this specification may begin removal of pipe insulation or other friable asbestos-containing material as per the following, or manufacturer's instructions. In case of conflict, the more stringent provisions shall apply.
1. Cut the sides of the glove bag to fit the size of pipe you will be working on and insert the tools you will need into the attached tool pocket.
 2. Attach the glove bag to the working area by folding the open edges together and sealing with staples and tape. Any additional support that may be necessary to support the weight of the debris shall be provided.
 3. Seal edges of the glove bag around the working area with tape or adjustable straps to form a tight seal. Slice open the side port to allow entry of the wetting tube and HEPA vacuum hose. Insert the nozzle from the portable sprayer, seal around it with tape, and thoroughly wet the area to be removed.
 4. Insert arms into the armholes and gloves and proceed to remove asbestos from the elbow, valve fitting or pipe. At locations where the insulation rests directly on pipe hangers or supports, the Contractor shall re-support the pipe by shimming with wood blocks or other suitable materials. Continue wetting the material as required. Thoroughly wet the remaining pipe and insulation material from the pipe or fitting. Cut back fiberglass six inches from asbestos to eliminate asbestos contamination. When the job has been completed, remove the spray nozzle, insert the HEPA vacuum nozzle, and turn on the HEPA vacuum to remove air from the bag.
 5. With the air removed from the glove bag, squeeze the bag tightly as close to the top as possible and twist seal and tape to keep the asbestos material safely at the bottom of bag. Turn off the HEPA vacuum, remove the hose from the side port, and seal the side port with tape.
 6. Cut and remove the glove bag from the working area and place it into another plastic bag. Move bags to holding area of disposal storage unit.
 7. Mist surfaces of protective polyethylene and carefully fold inward. Proceed to HEPA vacuum the work area for any residual materials and seal the exposed edges and piping with the proper encapsulant sealant.
 8. Once the removal has been completed, the Contractor is to notify Consultant that the area is ready for visual inspection. Once it has been determined that no visible debris remains, the consultant will initiate final air sampling.
 9. If testing results indicate fiber levels not acceptable by AHERA, the work area shall remain sealed until an acceptable concentration is obtained.
 10. All cleaning shall be accomplished using wet methods and/or HEPA vacuuming equipment. Replace objects that were moved to temporary locations in the course of the work, to their previous locations.

4.18 CLEAN-UP OF ASBESTOS-CONTAINING DEBRIS

- A. Related Sections: 02 82 13.19 - 4.3 (Work Areas), 4.4 (Decontamination Enclosure Systems), 4.5 (Separation of Work Areas), 4.6 (Maintenance of Decontamination Unit), 4.7 (Worker Protection), 4.8 (Communication), 4.9 (Fire Exits), 4.10 (Security), 4.11 (Location and Activation of Negative Air Units), 4.12 (Equipment Removal), and 4.13 (Pre-work Inspection).

- B. Pre-clean and remove all objects from over, near, and around the debris and store in area designated by the Owner.
- C. For removal of friable material over three (3) cubic feet or non-friable material not considered to be small scale short duration shall seal off all openings, including but not limited to corridors, doorways, skylights, ducts, grills, diffusers, and any other penetrations of the work areas, with 6-mil plastic sheeting sealed with tape. Open doorways and corridors with direct access to occupied areas shall be sealed with double barriers as described in 3.5 of this section. These critical barriers shall remain in place until the area has met the clearance criteria set forth in AHERA.
- D. For removal of friable material under three (3) cubic feet and non-friable material considered to be small-scale short duration abatement, rope off an area at least twenty-five feet (25') on all sides from work location to restrict personnel movement during the removal process and post the proper caution signs.
- E. Construct a decontamination unit (4.4) to meet regulations at the entrance to the work area.
- F. Post required warning signs.
- G. Establish negative pressure as stated in 4.11.
- H. Wet the debris with amended water. Do not allow the water to penetrate to the floors below.
- I. Using HEPA vacuums and wet cleaning methods remove the debris.
- J. Once the removal has been completed, the Contractor is to notify Consultant that the area is ready for visual inspection. Once it has been determined that no visible debris remains Consultant will initiate aggressive final air sampling. Consultant will provide final air sampling results to the Contractor and the Owner.
- K. If testing results indicate fiber levels not acceptable by AHERA, the work area shall remain sealed until an acceptable concentration is obtained.

4.19 REPAIR OF DAMAGED ASBESTOS-CONTAINING MATERIALS

- A. Related Sections: 02 82 13.19-4 – 4.2 (Work Areas), 4.4 (Decontamination Enclosure Systems) 4.7 (Worker Protection), 4.8 (Communication), 4.9 (Fire Exits), 4.10 (Security), 4.11 (Location and Activation of Negative Air Units), 4.12 (Equipment Removal), 4.13 (Pre-work Inspection), and 4 17 (Clean-up of Asbestos-containing Debris).
- B. Pre-clean and remove all objects near the damaged asbestos-containing materials and store in area designated by the Owner.
- C. Friable debris over three (3) cubic feet is present, seal off all openings, including but not limited to corridors, doorways, skylights, ducts, grills, diffusers, and any other penetrations of the work areas, with 6-mil plastic sheeting sealed with tape. Open doorways and corridors with direct access to occupied areas shall be sealed with double barriers as described in paragraph 3.5 of this section. These critical barriers shall remain in place until the area has met the clearance criteria set forth in AHERA.
- D. If friable debris under three (3) cubic feet is present, rope off an area at least twenty-five feet (25') on all sides work location to restrict personnel movement during the removal process and post the proper caution signs.

- E. Debris present on or around item to be removed shall be wetted and collected prior to any additional work.
- F. If no debris is present, rope off an area at least twenty-five feet (25') on all sides work location to restrict personnel movement during the removal process and post the proper caution signs.
- G. Construct a decontamination unit (4.4) at the entrance to the work area.
- H. Post required warning signs.
- I. Establish a negative pressure as stated in 4.11.
- J. Return areas of damaged materials to an undamaged and intact state using lag clothe, mastic or an appropriate material approved by the consultant.
- K. Seal exposed surfaces with mastic to form an airtight seal on the area repaired.
- L. Use methods to prevent the asbestos-containing materials from being further damaged during the repair.
- M. Repair damaged metal jacketing with 0.016" aluminum jacketing material, stucco embossed, with moisture barrier. Fasten jacketing material to existing metal jacket using sheet metal screws. Seal edges of repair material with silicone caulk or bridging encapsulant to form an airtight barrier.
- N. Once the removal has been completed, the Contractor is to notify Consultant that the area is ready for visual inspection. Once it has been determined that no visible debris remains Consultant will initiate aggressive final air sampling. Consultant will provide final air sampling results to the Contractor and the Owner.
- O. If testing results indicate fiber levels not acceptable by AHERA, the work area shall remain sealed until an acceptable concentration is obtained.

4.20 REMOVAL BY DISMANTLING

- A. Related Sections: 02 82 13.19 - 4.3 (Work Areas), 4.4 (Decontamination Enclosure Systems), 4.5 (Separation of Work Areas), 4.6 (Maintenance of Decontamination Unit), 4.7 (Worker Protection), 4.8 (Communication), 4.9 (Fire Exits), 4.10 (Security), 4.11 (Location and Activation of Negative Air Units), 4.12 (Equipment Removal), and 4.13 (Pre-work Inspection).
- B. Pre-clean and protect floors, walls, and surrounding area as necessary, within the work area with 6-mil polyethylene sheeting, tape and/or adhesives. As a minimum, extend polyethylene one foot horizontally in all directions for each vertical foot from floor to material height.
- C. Rope off an area at least twenty-five feet (25'), fifty (50) for outside work, on all sides work location to restrict personnel movement during the removal process and post the proper caution signs.
 - 1. Debris present on or around item to be removed shall be wetted and collected prior to any additional work.
 - 2. Vacuums equipped with HEPA filter, disposable dust bag, (no brush) shall be used to clean vertical and horizontal surfaces, as required.
 - 3. Item shall be detached from the building (if required) so has not to damage the building.
 - 4. During removal, if a mechanical saw is used a HEPA vacuum will follow the cutting action to capture all generated debris.

5. Caulk/sealants, if any, shall be removed as intact as is possible.
6. All scraping of residual caulk/adhesive remaining on building shall be performed using wet methods.
7. Dry sweeping is prohibited. Mechanical chipping is prohibited unless performed in a negative pressure enclosure.
8. Material shall not be drop. Material shall not be allowed to dry before placing in sealable polyethylene bags of 6-mil minimum thickness. All asbestos-containing material shall be removed thoroughly and totally. Nylon fiber brushes shall be used to clean asbestos fibers from rough surfaces. Any contaminated material capable of puncturing the polyethylene shall be packaged separately.
9. Maintain work areas free to accumulated asbestos-containing materials at all times. Keep waste materials wet until enclosed in sealed plastic bags.
10. Seal polyethylene bags airtight. Ensure that all contaminated materials are double bagged to yield a minimum covering of 12 mil before removed from the work area. Move the bagged material to the wash-down station adjacent to the equipment decontamination enclosure. Once in the decontamination area, the bags shall be wet cleaned, or HEPA vacuumed. Single bagged or wrapped material shall be placed in a clean bag or an additional layer of wrapping.
11. Once the removal has been completed, the Contractor is to notify Consultant that the area is ready for visual inspection. Once it has been determined that no visible debris remains Consultant will initiate aggressive final air sampling. Consultant will provide final air sampling results to the Contractor and the Owner.

4.21 REMOVAL OF CEILING TILE

- A. FULL ENCLOSURE: Related Sections: 02 82 13.19 - 4.3 (Work Areas), 4.4 (Decontamination Enclosure Systems), 4.5 (Separation of Work Areas), 4.6 (Maintenance of Decontamination Unit), 4.7 (Worker Protection), 4.8 (Communication), 4.9 (Fire Exits), 4.10 (Security), 4.11 (Location and Activation of Negative Air Units), 4.12 (Equipment Removal), and 4.13 (Pre-work Inspection).
- B. Any housing grills, vents, lights, or penetrations concealing asbestos-containing materials shall be lowered and/or removed and protected to provide access to the materials. Replacement or reattachment of these shall be in a manner such that function and appearance is equal to or exceeds the original condition.
- C. All fixtures, grills, clocks, intercom systems, lights, and any other metal objects shall be protected from amended water. Surfactant will cause oxidation. Painted surfaces shall also be protected. Gauges or other items susceptible to rust shall be cleaned with an acceptable substitute such as isopropyl alcohol.
- D. Spray asbestos-containing material with amended water, using spray equipment capable of providing a "mist" application to reduce the release of fibers. Saturate the material sufficiently to wet it to the substrate without causing excessive dripping. Remove the saturated asbestos material in small sections from all areas. Material drop shall not exceed fifteen feet (15'). For heights up to fifty feet (50'), provide inclined chutes to intercept drop. For heights exceeding fifty feet (50') provide enclosed, dust proof chutes. Material shall not be allowed to dry before placing in sealable polyethylene bags of 6-mil minimum thickness. All asbestos-containing material shall be removed thoroughly and totally. Nylon fiber brushes shall be used to clean asbestos fibers from rough surfaces. Any contaminated material capable of puncturing the polyethylene shall be packaged separately. If a metal grid is used to support the ceiling system, it is to be disposed of as asbestos contaminated waste.
- E. Maintain work areas free to accumulated asbestos-containing materials at all times. Keep waste materials wet until enclosed in sealed plastic bags.

- F. Seal polyethylene bags airtight. Ensure that all contaminated materials are double bagged to yield a minimum covering of 12 mil before removed from the work area. Move the bagged material to the wash-down station adjacent to the equipment decontamination enclosure. Once inside the washroom, the bags shall be wet cleaned or HEPA vacuumed and passed into the holding room. Single bagged material shall be placed in a clean bag or into a lined drum. At no time shall a removal worker pass the curtained doorway between the holding room and the container room.
- G. Once the removal has been completed, the Contractor is to notify Consultant that the area is ready for visual inspection. Once it has been determined that no visible debris remains Consultant will initiate aggressive final air sampling. Consultant will provide final air sampling results to the Contractor and the Owner.
- H. If testing results indicate fiber levels not acceptable by AHERA, the work area shall remain sealed until an acceptable concentration is obtained.

4.22 DISPOSAL OF ASBESTOS-CONTAINING MATERIAL AND ASBESTOS CONTAMINATED WASTE (SOLID AND/OR LIQUID)

- A. As the work progresses, and to prevent exceeding available storage capacity on-site, workers from uncontaminated areas in full protective clothing and dual cartridge respirators shall enter the equipment decontamination unit and place the appropriate supply of specified containers within the container room. Workers in the holding room shall be passed empty containers for receiving bagged material. Full, sealed containers from the holding room shall be passed back into the container room for storage. Ensure that all containers are sealed properly before removing for transport and disposal. The color of the disposable clothing worn outside the work area shall be a different color than the disposable clothing worn inside the work area. Drums will be required if Contractor uses sealed bins or enclosed trucks to store and transport double-bagged waste. Approval must be obtained from the Owners Representative prior to employment of this method.
- B. Vehicles used for transporting asbestos-containing materials to disposal sites shall have a completely enclosed, lockable storage compartment if drum requirement is to be deleted. Storage compartments shall be plasticized and sealed with a minimum of one (1) layer of 6-mil polyethylene on the sides and top and two (2) layers of 6-mil polyethylene on the floor. The compartments shall be thoroughly wet cleaned and/or HEPA vacuumed following the disposal of each load of material at the dumpsite. At the conclusion of the project (or before transport vehicles are used for other purposes), the polyethylene shall be properly removed and disposed of as contaminated waste. After this is accomplished, compartments shall once again be wet cleaned and/or HEPA vacuumed in order to eliminate all debris prior to reuse of the vehicles. Rented vehicles shall receive clearance inspection prior to being returned to the rental company. All plastic sheeting, tape, cleaning material, including mops and sponges, clothing, filters, and all other contaminated disposable materials shall be packaged, labeled, and disposed of as asbestos-containing waste.
- C. Dispose of materials at an authorized disposal site in accordance with the requirements of federal, state, and local disposal authorities.
- D. Workers unloading waste material at the disposal site shall be dressed in full-body protective clothing and dual cartridge respirators.

4.23 GROSS CLEANUP

- A. Remove all visible accumulations of asbestos containing materials and debris by HEPA vacuums, sponging, etc. Wet clean up surfaces within the work area.

- B. The entire work area shall be totally, visibly clean. The Contractor shall notify the on-site representative of the time the work area will be subject for visual inspection.

4.24 POST-REMOVAL ENCAPSULATION OF AFFECTED AREAS

- A. The work area shall have passed a visual inspection prior to post-removal encapsulation.
- B. An approved encapsulant shall be applied, using airless spraying equipment, to all areas of the project (except to flooring removal areas) where asbestos-containing materials have been removed. Encapsulants shall be color tinted for visibility.

4.25 ENCAPSULANTS

- A. The encapsulant shall be compatible with the replacement material as per manufacturer advice and approval by the Consultant.
- B. If any encapsulant is incompatible with the substrate, the Contractor shall be fully responsible for providing an alternate encapsulant that is compatible, at no additional cost to the Owner.
- C. "ABC – Asbestos Binding Compound" Multipurpose Asbestos Encapsulation System by Fiberlock or approved equivalent.
- D. Upon completion of encapsulant of surfaces from which asbestos has been removed, the Contractor shall inform the on-site representative that the area is ready for compliance monitoring.

4.26 TEST FOR FINAL CLEARANCES

- A. After all surfaces are wet wiped upon completion of asbestos removal and all areas within the work area are visually clean and encapsulated, negative air filtration will continue. If sampling yields air concentrations that are allowed by AHERA or this specification the removal shall be considered complete.

END OF SECTION

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

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 007300 “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 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 01 “Coordination” if included, for additional requirements.
 - 2. See Section 01 “Project Management Communications” if included, for additional requirements.

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 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 Architect/Engineer.
 - 2. Submit aggregate gradation data, if available aggregate does not meet the requirements of Section 2.3 Concrete Materials, to 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 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 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 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.

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. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 50 percent.
- B. Reinforcing Bars: ASTM A 615, Grade 60, deformed. Grade 40 may be used for stirrups and ties.
- C. 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.
- D. Welded Wire Fabric: ASTM A 185, welded steel wire fabric in sheet stock only.
- E. 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 I, or Type III.

- 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. Course 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. Walls 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 Architect/Engineer.

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) sieve or as recommended by the Geotechnical Engineering Report.
- B. Vapor Retarder: Provide polyethylene sheet (Class A minimum) complying with ASTM E1745, E154, D1709 and E96 above prepared base material at interior slabs on grade.
 - 1. Permeance Rating: 0.02 Perms or lower.
 - 2. Provide manufacturers recommended adhesive or pressure-sensitive tape for all sheet seams.
- C. Patching Compound: Cement-based compound for applications from one inch thick to feathered edges.
- D. Bonding Compound: Polyvinyl acetate or acrylic base.
- E. Foam Expansion Joint Filler: Polyethylene closed-cell expansion-joint filler. Provide WR Meadows, Deck-O-Foam expansion joint filler or equal.
- F. Joint Sealer: ASTM C 920.
- G. 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 Architect by Addendum during bidding period.
- H. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick (0.76 mm) with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.

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 Architect/Engineer for preparing and reporting proposed mix designs.
- B. Submit written reports to Architect of proposed mix. Do not begin concrete production until proposed mix designs have been approved by Architect/Engineer.

- C. Design mixes to provide normal weight concrete with the following properties, unless otherwise indicated on drawings and schedules:
1. All pad and strip footings and concrete bases for mechanical equipment shall have a 28 day $F'c = 3000$ psi.
 2. All other concrete including slabs on grade, grade beams and pile caps shall have a 28 day $F'c = 4000$ 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 $F'c = 4000$ psi; water-cement ratio between 0.40 and 0.45.
 2. **Note that concrete which is placed that exceeds the water cement ratios indicated will directly affect schedule for installation of floor finishes. Coordinate with overall schedule.**
- 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 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 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.

- b. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener:

- 1) 2 percent to 4 percent air.

- C. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.

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.

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, reglets, 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, reglets, 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 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 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 embedments.
- B. Install dovetail anchor slots in concrete structures as indicated on drawings.

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 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 Architect.

- B. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.
 - 1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances required by ASTM E 1155. Grind smooth surface defects that would telegraph through applied floor covering system.
 - 2. Finish slab on grade surfaces to the following tolerance according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F (F) 35; and of levelness F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness F(L) 17.

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

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.
- C. Grout under base plates to provide full bearing area after steel or equipment has been properly positioned and secured.

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 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 when approved by Architect. Remove and replace concrete that cannot be repaired and patched to 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. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
5. 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.
6. Submit product literature of bonding agent to be used and provide sample of repair for review by Architect/Engineer prior to commencement of repair operation.

3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. General: The Contractor will employ a testing laboratory to perform tests and to submit test reports to the 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 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 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 Architect/Engineer.

END OF SECTION 03 30 01

SECTION 04 22 00 - CONCRETE UNIT MASONRY

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. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Steel reinforcing bars.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Embedded flashing.
 - 7. Miscellaneous masonry accessories.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
- E. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
- B. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
- C. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 MASONRY UNITS, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance ratings-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners whether indicated on drawings or not.
- B. CMUs: ASTM C 90.
 - 1. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.5 CONCRETE AND MASONRY LINTELS

- A. General: Provide one of the following:

- B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc.; SGS Mortar Colors.
 - d. Or approved equal.
- E. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- F. Aggregate for Grout: ASTM C 404.
- G. Water: Potable.

2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Wire Size for Veneer Ties: 0.148-inch diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.8 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Cast-in-Place Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

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

- 1) Hohmann & Barnard, Inc; HB-5213-2X.
- 2) Hohmann & Barnard, Inc; HB Thermal Concrete 2-Seal Thermal Wing Nut Anchor.
- 3) Wire-Bond; RJ-711.

E. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.9 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

- C. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
 - 3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.10 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
 - 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - 3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 - 4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 5. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 6. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
 - 1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
- C. Application: Unless otherwise indicated, use the following:
 - 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 - 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 - 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
 - 4. Where flashing is fully concealed, use flexible flashing.
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use Portland cement-lime mortar unless otherwise indicated.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm).

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. At fire-rated partitions, treat joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- F. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

- B. Form control joints in concrete masonry as follows:
 - 1. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

- A. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING

- A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
 - 4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 - 5. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.

3.12 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Contractor will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.14 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste.
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00

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. Wood blocking, cants, and nailers.
 - 2. 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. WWPA: 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: AWPA 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 chloropyrifos 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 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

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. Solid surface countertops.

- B. Related Requirements:

- 1. Division 00 Section 00 73 00 "Supplementary Conditions", if included, for requirements relating to interpretation of the drawings and specifications.
- 2. Division 01 Section 01 21 00 "Allowances", if included, for use of allowances and what may and may not be included in them.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
- B. Rough carriages for stairs are a part of interior architectural woodwork. Platform framing, headers, partition framing, and other rough framing associated with stair work are specified in Division 06 Section "Rough Carpentry".

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including finishing materials and processes.

- B. Product Data: For solid-surfacing material.

- 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

- 1. Show details full size.

2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers and other items installed in architectural woodwork.

D. Samples for Initial Selection:

1. Solid-surfacing materials.

E. Samples for Verification:

1. Solid-surfacing materials, 6 inches (150 mm) square.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates

H. Qualification Data: For Installer and fabricator.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project, whose products have a record of successful in-service performance, and have sufficient capacity to produce required units without causing delay in the Work.

B. Installer Qualifications: Fabricator of products who can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with Solid Surface construction.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between **60 and 90 deg F (16 and 32 deg C)** and relative humidity between and 70 percent during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurement cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

2. PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products from one of the following manufacturers that may be incorporated into the Work:
 - a. ABA Industries.

- b. Avonite, Inc.
 - c. E. I. du Pont de Nemours and Company.
 - d. Formica Corporation.
 - e. LG Chemical, Ltd.
 - f. Meganite Inc.; a division of the Pyrochem Group.
 - g. Nevamar Company, LLC; Decorative Products Div.
 - h. Samsung; Cheil Industries Inc.
 - i. Swan Corporation (The).
 - j. Transolid, Inc.
 - k. Wilsonart International; Div. of Premark International, Inc.
2. Type: Standard type unless Special Purpose type is indicated.
3. Colors and Patterns:
- a. **SSM-1**, (Basis of Design) DuPont Corian Solid Surface, Style/Color – Glacier White.
 - b. Solid Surfacing Material Thickness: As indicated.
4. Sinks and Lavatories:
- a. (Basis of Design) Seamed Under-mount Restroom Lavatories: DuPont Corian Solid Surface Seamed Under-mount Restroom Lavatory **810**, Style/Color – Glacier White

2.2 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.
- 1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:
- 1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
 - 2. Interior Type: Low-hygroscopic formulation.

3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
 4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 5. Kiln-dry materials before and after treatment to levels required for untreated materials.
- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
1. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi (11 MPa); modulus of elasticity, 300,000 psi (2070 MPa); internal bond, 80 psi (550 kPa); and screw-holding capacity on face and edge, 250 and 225 lbf (1100 and 1000 N), respectively.
 2. For panels 13/16 to 1-1/4 inches (20 - 32 mm) thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi (9 MPa); modulus of elasticity, 250,000 psi (1720 MPa); linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf (1100 and 780 N), respectively.
 3. Product: Subject to compliance with requirements, provide "Duraflake FR" by Weyerhaeuser.
- D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
1. Product: Subject to compliance with requirements, provide "Meditate FR" by SierraPine Ltd.; Mediate Div.

2.3 MISCELLANEOUS MATERIALS

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

- D. Adhesives: Do not use adhesives that contain urea formaldehyde.
- E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: 30 g/L.
 - 2. Contact Adhesive: 250 g/L.
- F. Fasteners: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for screws; FS FF-N-105 for nails.

2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4-inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
 - 2. Edges of Rails and Similar Members More Than 3/4-inch (19 mm) Thick: 1/8-inch (3 mm).
 - 3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16-inch (1.5 mm).
- E. Complete fabrication, including assembly, finishing and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trim fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

- F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.
- G. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual". For glass in wood frames, secure glass with removable stops.

2.5 SOLID-SURFACING MATERIAL COUNTERTOPS

- A. Quality Standard: Comply with AWI Section 400 and its Division 400C "Countertops".
- B. Grade: Custom.
- C. Solid-Surfacing Material Thickness: 1/2-inch (13 mm)
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of solid surfacing complying with the following requirements:
 - 1. As indicated by manufacturer's designations
- E. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate tops with shop-applied edges of materials and configuration indicated.
 - 2. Fabricate tops with loose backsplashes for field application.
- F. Install integral sink bowls in countertops in shop.
- G. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

3. PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" (3 mm in 2400 mm) for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.
- B. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- C. Fire-Retardant Treated Wood: Handle, store, and install fire-retardant treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk, and filled flush with woodwork and matching final finish if transparent finish is indicated.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members. Stagger joints in adjacent and related members. Cope at returns and miter at corners.
 - 1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
 - 2. Install wall railings on indicated metal brackets securely fastened to wall framing.
 - 3. Install standing and running trim with no more variation from a straight line than 1/8-inch in 8'-0" (3 mm on 2400 mm).
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Align adjacent solid-surfacing material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than 1/8-inch in 8'-0" (3 mm in 2400 mm) sag, bow, or other variation from a straight line.
 - 3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
 - 4. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants".
- G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- H. Quality Standard: Install woodwork to comply with AWI Section 1700. Quality Standard: Install woodwork to comply with AWI Section 1700.

- I. Miscellaneous Accessories: Install per manufacturer's instructions using fasteners appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored, at locations as indicated on drawings.

3.3 ADJUSTING AND CLEANING

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

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, which ensures that woodwork is without damage or deterioration at time of Substantial Completion.

END OF SECTION 06 40 23

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: 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.
- B. 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.
- C. 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" for door hardware for hollow-metal 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
 - 6. Or equal if and as specifically approved by Architect by Addendum during the bidding period.
- 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. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch (1.0 mm).
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - b. Construction: Full profile welded.
4. 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. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 4. 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. Glazing: Comply with requirements in Section 08 80 00 "Glazing."
- K. 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 Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
 - 4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 - 5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 - 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19

mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

- C. 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.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. 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.
- F. 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.

- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
 - c. At Bottom of Door: 3/4 inch (19.1 mm) plus or minus 1/32 inch (0.8 mm).
 - d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

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 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.
- 2. Cylinders for door hardware specified in other Sections.

- B. Related Sections:

- 1. Section 081113 "Hollow Metal Frames"

1.3 REFERENCES

- A. The following reference standards and model code documents shall be used in estimating and detailing door hardware, and shall be considered as a standard of quality, function, and performance, as applicable:

- 1. I.B.C. International Building Code (current year adopted).
- 2. NFPA-80 Fire Doors & Windows (current year adopted).
- 3. NFPA-101 Life Safety Code (current year adopted).
- 4. NFPA-105 Smoke Control Door Assembly. (current year adopted)
- 5. ANSI-117.1 1992 Edition Providing Accessibility and Usability for Handicapped People. Physically
- 6. A.D.A.A.G Americans with Disabilities Act Accessibility Guidelines.

1.4 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: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - d. 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) Fastenings and other pertinent information.
 - 5) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 6) Mounting locations for door hardware.
 - 7) 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Architectural Hardware Consultant.

- B. 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.

- C. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

- 1. For door hardware, an Architectural Hardware Consultant (AHC).

- B. Source Limitations: Obtain each type of door hardware from a single manufacturer.

- C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

- D. 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.

- E. 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.

- F. 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. 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.
- G. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and factory authorized Technical Representative of the permanent cylinder core manufacturer. Technical Representative's presence shall be arranged for and scheduled by the Contractor and name, signature, and date of attendance of that Technical Representative shall appear on the keying schedule. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 2. Preliminary key system schematic diagram.
 3. Requirements for key control system.
 4. Requirements for access control.
 5. Address for delivery of keys.
- H. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Inspect and discuss preparatory work performed by other trades.
 3. Review sequence of operation for each type of electrified door hardware.
 4. Review required testing, inspecting, and certifying procedures.

1.8 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 to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.9 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.10 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. Locks: Seven years from date of Substantial Completion.
- b. Exit Devices: Two years from date of Substantial Completion.
- c. Manual Closers: 10 years from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

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 products equivalent in function and comparable in quality to named products.
- 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. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
- B. Provide 5-knuckle, ball bearing, heavy-weight hinges not less than 0.180" thick.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. IVES Hardware; an Allegion company.
 - b. Baldwin Hardware Corporation.
 - c. Bommer Industries, Inc.

2.3 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.

- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Cylindrical locks: Minimum **3/4-inch (19-mm)** latchbolt throw.
 - 2. Mortise Locks: Minimum **3/4-inch (19-mm)** latchbolt throw.

- C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

- D. Lock Trim:
 - 1. Operating Device: Lever with rose.

- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

- F. Cylinders: Locks must be capable of accepting Best Access Systems Stanley Security Solutions, 7-pin, interchangeable removable core, "CORMAX, ICX7X2W2"

- G. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Best Lock; 93K Series Lock; a Stanley/Best company.
 - b. Falcon Lock; T Series; an Allegion company.
 - c. PDQ XGT Series.

2.4 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3. Grade 1, and UL listed for Panic Exit and/or Fire Exit Hardware.

- B. Exit devices to incorporate a deadlatching feature for security and/or for future addition of alarm kits and/or other electrical requirements.

- C. Exit devices are to incorporate a flush and tapered end cap. Exit devices shall incorporate a fluid damper or other device that eliminates noise associated with exit device operation.

D. Provide electrical options as scheduled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Von Duprin; 99 Series; an Allegion company.
 - b. Detex Apex Series.
 - c. Falcon 25 Series; an Allegion Company.

2.5 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Best Locks; a Stanley/Best company - Product to match existing systems.

B. Standard Lock Cylinders: Furnish Best Access Systems Stanley Security Solutions, 7-pin, interchangeable removable core to match existing key system. To satisfy Owners security and keying requirements cylinders shall be delivered directly from manufacturer's factory to Owner's designated Representative. Permanent cores will be installed at the site by Owner's designated representative.

C. Construction Cores: Provide construction cores for all locks/cylinders.

2.6 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A.

1. Existing Key System: All locks/cylinders shall be keyed to existing Best key system. Verify type required.
2. Supplier shall be responsible for coordinating with the Base Locksmith and Real Property Manager a key control system and procuring all the necessary keys and cores as required.
3. Incorporate decisions made in keying conference. Manufacturers keying specialist to assist in layout and design of new keys system.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with patent number and designation determined by base locksmith and include the following notation:
 - a. Notation: "US GOVT. - DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:
 - a. Cylinder Change Keys: Two.
 - b. Master Keys: Five for each master key system.
 - c. Control Keys: One.
 - d. Construction Master Keys: Three.
 - e. Blank Keys: One per lock.

2.7 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; brass, unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. IVES Hardware; an Allegion company.
 - b. Rockwood Manufacturing Company.
 - c. Trimco.

2.8 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
- B. Astragals: BHMA A156.22.

2.9 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves, cast iron body, and forged-steel main arm.
- B. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- C. Closer cylinders, arms, adapter plates, and metal covers shall have a powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117.
- D. Closers with pressure relief values will not be acceptable.
- E. Supplier to provide any brackets or plates required for proper Installation of door closers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. LCN Closers; 4040XP Series; an Allegion company.
 - b. Sargent 280 Series; an ASSA Abloy company.

2.10 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reese Enterprises, Inc.
 - b. National Guard Products.
 - c. Zero International.

2.11 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. IVES Hardware; an Allegion company.
 - b. Rockwood Manufacturing Company.
 - c. Trimco.

2.12 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. IVES Hardware; an Allegion company.
 - b. Rockwood Manufacturing Company.
 - c. Trimco.

2.13 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. Use of through bolts is not acceptable. Verify correct blocking is provided in door/frame specifications.

 - 2. **Fire-Rated Applications:**
 - a. **Wood or Machine Screws:** For the following:
 - 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.

 - 3. **Fasteners for Wood Doors:** Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
 - 4. **Gasketing Fasteners:** Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.14 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.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. 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 indicated in keying schedule or directed by Owner.
- E. Thresholds: Set thresholds for doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- F. Stops: Provide wall stops for doors unless floor or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic or pose a tripping hazard.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame. Apply soffit mounted seals prior to soffit mounted hardware.
- 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. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three 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. Contractor to instruct owner’s personnel to adjust, operate, and maintain door hardware and door hardware finishes.

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, conflicting 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

DOOR NUMBER:

	012	014	015	035		
EACH TO HAVE:						
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR	
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE	
1	EA	PANIC HARDWARE	99-NL	626	VON	
1	EA	RIM CYLINDER	1E72	626	BES	
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN	
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE	
1	EA	RAIN DRIP	142AA	AA	ZER	
1	SET	GASKETING	429AA-S	AA	ZER	
1	EA	DOOR SWEEP	39A	A	ZER	
1	EA	THRESHOLD	65A-223	A	ZER	

HARDWARE SET 02

DOOR NUMBER:

018

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY	313AN	IVE
1	EA	PANIC HARDWARE	9947-DT	626	VON
1	EA	PANIC HARDWARE	9947-NL	626	VON
1	EA	RIM CYLINDER	1E72	626	BES
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
1	EA	RAIN DRIP	142D	D	ZER
1	EA	WEATHERSTRIPPING	BY DOOR AND FRAME MANUFACTURER		
2	EA	DOOR SWEEP	39D	D	ZER
1	EA	THRESHOLD	65A-223	A	ZER

HARDWARE SET 03

DOOR NUMBER:

018A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	DUMMY PUSH BAR	330	626	VON
2	EA	TRIM	990-DT	626	VON
2	EA	SURFACE CLOSER	4040XP HEDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET 04

DOOR NUMBER:

023

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	PANIC HARDWARE	9927-L-LBR-06	626	VON
2	EA	RIM CYLINDER	1E72	626	BES
2	EA	SURFACE CLOSER	4040XP HEDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	MEETING STILE	8193AA	AA	ZER

HARDWARE SET 05

DOOR NUMBER:

002 003

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCKSET	93K 7D 15D	626	BES
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET 06

DOOR NUMBER:

005

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCKSET	93K 7D 15D	626	BES
1	EA	OH STOP	90S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET 07

DOOR NUMBER:

005A 014A 014B 027

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCKSET	93K 7R 15D	626	BES
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA (AT RATED DOORS)	BK	ZER
3	EA	SILENCER	SR64 (AT NON-RATED DOORS)	GRY	IVE

HARDWARE SET 08

DOOR NUMBER:

016 017 019 020

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCKSET	93K 7AB 15D	626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA (AT RATED DOORS)	BK	ZER
3	EA	SILENCER	SR64 (AT NON-RATED DOORS)	GRY	IVE

HARDWARE SET 09

DOOR NUMBER:

001 004 033

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCKSET	93K 7AB 15D	626	BES
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE SET 10

DOOR NUMBER:

006 007 013A 021

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CYL X THUMBTURN DEADBOLT	83T7K	626	BES
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 RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET 11

DOOR NUMBER:

000

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	STOREROOM LOCKSET	93K 7D 15D	626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH (ACTIVE LEAF)	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	MEETING STILE	383AA	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	65A-223	A	ZER

HARDWARE SET 12

DOOR NUMBER:

013

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	CYL X THUMBTURN DEADBOLT	83T7K	626	BES
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
2	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

DOOR/HARDWARE SET INDEX

Door#	HwSet#
000	11
001	09
002	05
003	05
004	09
005	06
005A	07
006	10
007	10
012	01
013	12
013A	10
014	01
014A	07

Door#	HwSet#
014B	07
015	01
016	08
017	08
018	02
018A	03
019	08
020	08
021	10
023	04
027	07
033	09
035	01

END OF SECTION 087100

SECTION 08 80 00 - GLAZING

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. See Section 00 73 00 "Supplementary Conditions", if included, for requirements relating to interpretation of the drawings and specifications.

1.2 SUMMARY

- A. This Section includes glazing for the following products:
 - 1. Entrances and other doors.

1.3 SUBMITTALS

- A. Product data for each glass product and glazing material indicated.
- B. Samples of manufacturer's standard sealant colors for selection by Architect.
- C. Samples of glass to include tinted glass.

1.4 QUALITY ASSURANCE

- A. Glazing Publications: Comply with "FGMA Glazing Manual" and "LSGA Design Guide," except where more stringent requirements are indicated.
- B. Safety Glass: ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC).
- C. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar to that indicated for Project.
 - 1. Note that the glazing subcontractor shall provide safety glazing in all locations where required by the Building Code whether shown on the drawings or not.
 - a. The glazing subcontractor shall verify which version of the Building Code has been adopted by the governing authority where the project will be built.

- D. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar to that indicated for Project.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials.

1.6 WARRANTY

- A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contactor under requirements of the Contract Documents.
- B. Manufacturer's Warranty on Insulating Glass: Submit written warranty signed by manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in "Definitions" article, f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.
 - 1. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, provide products of the following:
 - 1. Ford Glass Division
 - 2. Libby-Owens-Ford Co.
 - 3. P.P.G. Industries, Inc.
- B. See Glass Schedule at the end of this section for specific glass types.

2.2 ELASTOMERIC GLAZING SEALANTS

- A. General: Comply with glass manufacturer's recommendations.
- B. Colors: As selected by Architect from manufacturer's standards.
- C. Elastomeric Glazing Sealant Standard: ASTM C 920.

2.3 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with 100% solids content, nonstaining and nonmigrating, with or without spacer rod as recommended by tape and glass manufacturers, and complying with AAMA 800.

2.4 GLAZING GASKETS

- A. Glazing Gaskets: Resilient polyvinylchloride or other material as required.

2.5 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers and Sealers: As recommended by sealant or gasket manufacturer.
- B. Setting Blocks: Shore A durometer hardness of 85 plus or minus 5.

- C. Spacers: Blocks or extrusions with a Shore A durometer hardness as required.
- D. Edge Blocks: As needed to limit glass lateral movement (side-walking).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with installation tolerances; minimum required face or edge clearances; and effective sealing between joints of glass-framing members.

3.2 PREPARATION

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

3.3 GLAZING

- A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass from edge damage during handling and installation. Use a rolling block in rotating glass to prevent damage to corners. Use suction cups to shift glass within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges.
- C. Apply primers to joint surfaces where required for adhesion of sealants.
- D. Install elastomeric setting blocks, sized and located to comply with glazing standard. Set blocks in thin course of sealant suitable for heel bead.
- E. Provide spacers for glass sizes larger than 50 united inches. Provide 1/8 inch minimum bite and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- F. Provide edge blocking to comply with requirements of referenced publications.

3.4 PROTECTION AND CLEANING

- A. Protect glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction for build-up of alkali deposits or stains and remove as recommended by glass manufacturer.
- C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.
- D. Wash glass on both faces in each area of Project not more than 4 days prior to Substantial Completion. Wash glass as recommended by glass manufacturer.

3.5 GLASS SCHEDULE

A. CLEAR INSULATING SAFETY GLASS

1. Description: Type I, Class 1, Quality q3, Kind FT, Condition A.
2. Low Emissivity Coating: Magnetically sputtered on second surface.
3. Thickness: 1/4" glass, 1/2" air space, 1" overall.

END OF SECTION 08 80 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 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.

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
 - b. Depth: 3-5/8 inches (92 mm) unless otherwise indicated.

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 by Addendum during the bidding period.

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 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.

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 by Addendum during bidding period.** 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. **Basis-of-Design—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 Armstrong SuperCoat Touch Up Paint.

1. Or equal product from other approved manufacturers subject to compliance w/ Basis of Design product requirements, if and as specifically approved by Architect by Addendum during bidding period.

- 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 (BY ALTERNATE ONLY)
 - 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 (BY ALTERNATE ONLY)

- A. Subject to compliance with requirements, provide the following:
 - 1. Basis of Design: Builder's Choice, #1524 WG-DRY, Oak
 - a. LVT-1, Color – #08 Light Brown.
 - 1) Installation Method: As drawn
 - 2. Other equivalent products may be used only if specifically approved by Architect by Addendum during bidding period.

2.2 THERMOSET-RUBBER BASE

- A. Subject to compliance with requirements, provide products by the following:
 - 1. Basis of Design; Aladdin Commercial
 - a. Product: Thermoset Rubber Wall Base, 4" H Coved.
 - 1) RB-1 Color: #073 Mushroom
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style B, 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 Concrete: 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 00 "Resilient 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 03 Section "Cast-In-Place Concrete" for concrete sealing requirements.
2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
4. Division 09 Sections for special use-coatings.
5. Section 09 67 13 "Broadcast-Applied Decorative Flake Resinous Flooring".
6. Section 09 96 00 "High-Performance Coatings".
7. Section 09 96 13 "Fiber-Reinforced Abrasion Resistant 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.**

2.2 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Contractor 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. Finish doors on tops, bottoms and side edges same as faces.

- J. 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: Contractor 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—Walls	Semi-Gloss	CONC-21
Interior Concrete Slabs—Existing	Sealer	CONC-411
Interior CMU	Semi-Gloss	CMU-21-EXISTING
Interior Exposed Structural Ceilings	Flat	ESC-21
Interior Ferrous Metal	Semi-Gloss	FM-41
Interior Ferrous Metal	Aluminum	FM-61
Interior Gypsum Drywall /Plaster	Flat	GDW-21
Interior Gypsum Drywall / Plaster	Semi-Gloss	GDW-41
Interior Painted Wood	Semi-Gloss	IPW-1

3.7 INTERIOR PAINTING SYSTEMS

A. System CONC-21 for application on Interior Concrete—Semi-Gloss Walls:

1. Semi-Gloss Latex Enamel Finish: Two (2) coats over penetrating and sealing conditioner with total dry film thickness not less than 3 mils dry.
2. Latex Acrylic Concrete Primer: To prime and seal concrete surfaces prior to finishing:
 - a. DV: OmniPrep Universal Interior Primer.
 - b. Moore: ULTRA SPEC® Masonry Interior/Exterior 100% Acrylic Sealer, 608.
 - c. Moore: FRESH START® Multi-Purpose Latex Primer, N023.
 - d. PPG Paints: PERMA-CRETE® Interior/Exterior Alkali Resistant Primer.
 - e. S-W: Loxon® Interior/Exterior Concrete & Masonry Primer/Sealer, LX02 Series.
3. Interior Semi-Gloss Odorless Latex Enamel: Two (2) coats of Low odor, semi-gloss, enamel for use over a primer on concrete and masonry.
 - a. DV: Zero Plus Interior Zero VOC* Latex - Semi Gloss.
 - b. Moore: SUPER HIDE® Zero VOC Interior - Semi-Gloss, 358.
 - c. PPG Paints: SPEEDHIDE® Zero Interior Latex - Semi-Gloss.
 - d. PPG Paints: PURE PERFORMANCE® Interior Latex - Semi-Gloss Enamel.
 - e. S-W: ProMar® 200 Zero V.O.C. - Semi-Gloss, B31 Series.
 - f. S-W: Harmony® Interior Acrylic - Semi-Gloss, B10 Series.

B. 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™/Laticrete: Seal Hard®.
 - c. W.R. Meadows, Inc.: Liqui-Hard®.
 - d. SpecChem, LLC: SpecHard.
 - e. Prosoco® Consoliddeck® LS/CS®.
 - f. Or equal if and as specifically approved by Architect by Addendum during the bidding period.

C. System CMU-21—EXISTING for application on Previously Painted Interior CMU—Semi-Gloss- Restrooms, Mechanical Rooms, Electrical Rooms, Janitor's Closets, or Other Wet Areas:

1. Semi-Gloss Latex Enamel Finish: Two (2) coats over primed surface with total dry film thickness not less than 3.5 mils excluding adhesion primer.
2. High Performance Latex Adhesion Primer: Heavy Duty latex adhesion primer used for priming textured interior concrete masonry block before application of top coats:
 - a. DV: OmniPrep Universal Interior Primer.
 - b. Moore: ULTRA SPEC® Masonry Hi-Build Interior-Exterior Block Filler, 571.
 - c. PPG Paints: SEAL GRIP® Interior/Exterior Universal Primer/Sealer.
 - d. PPG Paints: PERMA-CRETE® Interior/Exterior Alkali Resistant Primer.
 - e. S-W: ProBlock® Latex Primer, B51 Series.
 - f. S-W: Loxon® Interior/Exterior Concrete & Masonry Primer/Sealer, LX02 Series.
3. Interior Semi-Gloss Odorless Latex Enamel: Two (2) coats of Low odor, semi-gloss, enamel for use over a primer on concrete and masonry.
 - 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. PPG Paints: SPEEDHIDE® Zero Interior Latex - Semi-Gloss.
 - f. S-W: ProMar® 200 Zero V.O.C. – Semi-Gloss, B31 Series.
 - g. S-W: Harmony® Interior Acrylic – Semi-Gloss, B10 Series.

D. 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.

E. 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.
 - 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.

F. 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-Acryl 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.

G. 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.
 - f. S-W: Harmony® Interior Acrylic – Flat, B5 Series.

H. 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.

I. System IPW-1 for Application on Interior Wood.

- 1. Interior Semi-Gloss Latex: Two (2) coats over primer per manufacturer's recommendations.
- 2. Factory formulated acrylic primer for interior application on wood:
 - a. DV: Mill Max Interior Latex Enamel Undercoat.
 - b. Moore: FRESH START® Multi-Purpose Latex Primer, N023.
 - c. PPG Paints: SEAL GRIP® Interior/Exterior Universal Primer/Sealer. (1.5 dry mils).
 - d. S-W: Premium Wall & Wood Interior Latex Primer, B28 Series (1.8 dry mils).
 - e. Or equal, if and as specifically approved by Architect by Addendum during bidding period.
- 3. Interior Semi-Gloss Latex Finish.
 - a. DV: Nu-Cling Acrylic Latex Enamel - Satin.
 - b. Moore: ADVANCE® Waterborne Interior Alkyd – Semi-Gloss,
 - c. PPG Paints: ~~PPG~~ ADVANTAGE™ 900 Interior/Exterior - Semi-Gloss. (1.4 dry mils per coat).
 - d. S-W: ProClassic® Waterborne Interior Acrylic – Semi-Gloss, B31 Series. (1.4 dry mils).

END OF SECTION 09 91 23

SECTION 09 96 00 – HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Interior Substrates:
 - a. Concrete, vertical and horizontal surfaces.
 - b. Clay masonry.
 - c. Concrete masonry units (CMUs).
 - d. Steel.
- B. Related Requirements:
 - 1. Section 09 67 13 "Broadcast-Applied Decorative Flake Resinous Flooring".
 - 2. Section 09 91 23 "Interior Painting".
 - 3. Section 09 96 00 "High-Performance Coatings".
 - 4. Section 09 96 13 "Fiber-Reinforced Abrasion Resistant Coatings".

1.3 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
- B. ASTM (ASTM)
 - 1. ASTM D 1308, "Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes".
 - 2. ASTM D 2486, "Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints".
 - 3. ASTM D 2794, "Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)".
 - 4. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials".

1.4 ACTION SUBMITTALS

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

- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 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. Mock-ups: Apply mock-ups 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 coating system.
 - 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 mock-ups after permanent lighting and other environmental services have been activated.
 - 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.

1.7 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 50 deg F (10 deg C).
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 80 deg F (10 and 27 deg C).
- B. Do not apply coatings 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.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

1.9 WARRANTY

- A. Special Warranty: The manufacturer shall warrant the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials for a period of five years from date of Substantial Completion. This special warranty shall extend the one-year period of limitations contained in the General Conditions.

PART 2 - PRODUCTS

2.1 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 3. Products shall be of same manufacturer for each coat in a coating system.

2.2 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
 1. Contractor will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating 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 non-complying 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.

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. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and CMUs): 12 percent.
 4. Wood: 15 percent.
 5. Gypsum Board: 12 percent.
 6. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Verify compatibility with and suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.
- G. 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 applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, 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 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.
1. Clean surfaces with pressurized water. Use pressure range of **1500 to 4000 psi (10 350 to 27 580 kPa)** at 6 to 12 inches (150 to 300 mm).
 2. Abrasive blast clean surfaces to comply with SSPC-SP 13 / NACE No. 6, "Surface Preparation of Concrete." **Affirm that the surface is free of contaminants prior to abrasive blast, shot-blast, or mechanical abrasion of concrete surface in accordance with SSPC-SP 13 / NACE No. 6 and manufacturer's recommendations.**
- E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.
1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi (690 to 4140 kPa) at 6 to 12 inches (150 to 300 mm).
- F. Glazed Masonry Substrates: Thoroughly clean off oil, wax, grease, and other residues. De-gloss with either mechanical abrasion or chemical etch. Remove sanding dust with a clean, wet rag.
- G. Glazed Ceramic Tile Substrates: Thoroughly clean off oil, wax, grease, and other residues. De-gloss with either mechanical abrasion or chemical etch. Remove sanding dust with a clean, wet rag.
- H. 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 7/NACE No. 4, "Brush-Off Blast Cleaning".
 2. SSPC-SP 11, "Power Tool Cleaning to Bare Metal".
 3. SSPC-SP 6/NACE No. 3.
 4. SSPC-SP 10/NACE No. 2.
 5. SSPC-SP 5/NACE No. 1.
- I. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces. **ALKYD PRIMERS ARE NOT PERMITTED ON HIGH-PERFORMANCE-COATED METAL SURFACES, Typ**
- J. Existing Galvanized-Metal Substrates: Remove all visible oil, grease, soil, dirt, mold and mildew, and other soluble contaminants in accordance with SSPC-SP WJ4/NACE WJ4. **ALKYD PRIMERS ARE NOT PERMITTED ON HIGH-PERFORMANCE-COATED METAL SURFACES, Typ.**
1. Remaining coatings shall have an adhesion of 2A or 2B or better when tested in accordance with ASTM D 3359. If remaining intact coating is hard and glossy, uniformly dull and abrade.
 2. All rusted, exposed steel shall be Commercial Power Tool Cleaned in accordance with SSPC-SP15.
- K. Aluminum Substrates: Remove loose surface oxidation.

L. Stainless Steel Substrates: Remove all forms of surface contaminants. Clean using methods recommended in writing by paint manufacturer to include washing with a water-based degreasing agent. Soaps and degreasers must be thoroughly rinsed:

1. SSPC-SP 11, "Commercial Grade Power Tool Cleaning" to achieve an anchor profile of 1.0 – 1.5 mils.

M. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer that is recommended in writing by topcoat manufacturer for coating system indicated.
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 filler that is recommended in writing by topcoat manufacturer for coating system indicated. Sand smooth when dried.

3.3 APPLICATION

A. **Provide finish coats compatible with the primers used.**

B. Apply high-performance coatings according to manufacturer's written instructions and recommendations.

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

a. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor 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.

4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. 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.

D. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

E. 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.

F. 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.

3.4 FIELD QUALITY CONTROL

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

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.
- E. Provide "Wet Paint" signs to protect newly coated finishes.
- F. Refer to the drawings, room finish schedules and notes for paint requirements. Architect shall approve all "match adjacent surfaces" colors before painting begins.

3.6 HIGH-PERFORMANCE COATINGS, GENERAL

- A. 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.
- B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - 2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - 3. Anticorrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content of not more than 250 g/L.
 - 4. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - 5. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - 6. Floor Coatings: VOC not more than 100 g/L.
 - 7. Shellacs, Clear: VOC not more than 730 g/L.
 - 8. Shellacs, Pigmented: VOC not more than 550 g/L.
 - 9. Stains: VOC content of not more than 250 g/L.

10. Flat Interior Topcoat Paints: VOC content of not more than 50 g/L.
11. Nonflat Interior Topcoat Paints: VOC content of not more than 150 g/L.
12. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L,
14. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
15. Pre-Treatment Wash Primers: VOC content of not more than 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 1 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. Colors: See Finishes Legend

E. HIGH-PERFORMANCE COATINGS SCHEDULE

<u>LOCATION</u>	<u>SHEEN</u>	<u>COATINGS SYSTEM</u>
Interior CMU	Semi-Gloss	CMU-321 (PTE)
Interior Gypsum Drywall (Epoxy)	Eggshell/Semi-Gloss	GDW-51 (PTE)
Interior Concrete Slabs	Urethane Resin Flrs	CONC-4 (EPX-2)

3.7 EXTERIOR HIGH-PERFORMANCE COATING SYSTEMS

A. **System CMU-321 for application on Interior CMU/Concrete:**

1. Semi-Gloss Water-based two-component Acrylic Polyurethane Finish: One (1) intermediate coat and one (1) finish coat over block filler.
2. High Performance Latex Block Filler: Heavy Duty latex block filler used for filling open textured interior concrete masonry block before application of waterborne acrylic urethane finish top coats.
 - a. Thickness—Apply as many coats as necessary to produce a uniform substrate appearance. Do not exceed manufacturer's recommended coverage rate. Allow to dry prior to application of subsequent coats.
 - b. DV: UniFill Acrylic Block Filler.
 - c. Moore: ULTRA SPEC® Masonry Hi-Build Interior-Exterior Block Filler, 571.
 - d. PPG Paints: SPEEDHIDE® Interior/Exterior Masonry Latex Block Filler (Hi-Fill). Apply at a DFT of not less than @ 8.0 mils DFT.
 - e. S-W: Pro Industrial™ Heavy Duty Block Filler, B42W46. Apply at a DFT of not less than @ 8.0 mils DFT.
 - f. Or equal, if and as specifically approved by Architect by Addendum during bidding period.
3. Intermediate Coat—Semi-Gloss Water-based Acrylic Polyurethane: Opaque coat for use over primed, interior CMU surfaces: Scrub Test = 12,000 scrub cycles per ASTM D 2486. Application—Spray or roll finish to completely cover primer and according to manufacturer's written instructions. Apply in a continuous, even film at manufacturer's specified coverage rate. Finish/Sheen—Semi-Gloss. Color as selected by Architect:
 - a. Moore: Ultra Spec® SCUFF-X® Interior Latex Satin, #486 / Semi-Gloss, #487.
 - b. Scuffmaster: ICP (Master Coating Technologies)— MAX (Semi-Gloss).
 - c. Or equal, if and as specifically approved by Architect by Addendum during bidding period.
4. Finish Coat—Semi-Gloss Water-based Acrylic Polyurethane: Opaque coat for use over intermediate coat, for application on interior CMU surfaces. Scrub Test = 12,000 scrub cycles per ASTM D 2486. Finish/Sheen—Semi-Gloss. Color as selected by Architect:
 - a. Moore: Ultra Spec® SCUFF-X® Interior Latex Satin, #486 / Semi-Gloss, #487.
 - b. Scuffmaster: ICP (Master Coating Technologies)— MAX (Semi-Gloss).
 - c. Or equal, if and as specifically approved by Architect by Addendum during bidding period.

B. **System GDW-51 (PTE-2) for application on Interior Gypsum Drywall:**

1. Semi-Gloss Latex Epoxy Finish: Two (2) finish coats over primer.
2. Latex-Based Interior White Primer: Latex-based primer coating used on interior gypsum drywall under an epoxy finish:
 - a. PPG Paints: PURE PERFORMANCE® Interior Latex Primer.
 - b. SW: ProMar® 200 Zero V.O.C. Interior Latex Primer, B28 Series.
 - c. Or equal, if and as specifically approved by Architect by Addendum during bidding period.
3. Semi-Gloss Latex Epoxy Finish: Color as selected by Architect from manufacturer's standards:
 - a. PPG Paints: PITT-GLAZE® WB1 Interior Pre-Catalyzed Waterborne Acrylic Epoxy - Semi-Gloss. Applied at 1.5 DFT.

- b. SW: Pro Industrial™ Water-Based Catalyzed Epoxy - Semi-Gloss, B70W211 / B60V25, applied at 2.5 – 3 mils dry per coat.
- c. Or equal, if and as specifically approved by Architect by Addendum during bidding period.

C. **System EPX-2 for application on Interior Concrete Floors —Urethane Resinous Finish over Waterproof Membrane:**

1. Products: **Basis of Design—Tnemec, Ultra Tread S, Series 245, three-component, polyurethane modified concrete.** Subject to compliance with requirements, provide one of the following:
 - a. Tnemec: UltraTread S, Series 245.
 - b. Dur-A-Flex: **System equal to Basis of Design product/system.**
 - c. PPG Paints: Shock-Crete Resinous Urethane.
 - d. Prime Coat Coating Systems:
System equal to Basis of Design product/system.
 - e. SW: FasTop® 12 S Urethane Slurry System, cementitious self-leveling system.
 - f. Or equal, if and as specifically approved by Architect by Addendum during bidding period.

2. System Characteristics:
 - a. Color and Pattern:
To be selected by Architect from manufacturer's standard range of colors.
 - b. Wearing Surface:
Textured for slip resistance, match Architect's sample.
 - c. Integral Cove Base:
4 inches high.
 - d. Overall System Thickness:
1/8" finish over sloped patching and fill material.

3. **Basis of Design System Components:** Manufacturer's standard components that is compatible with each other and as follows.
 - a. Primer: Manufacturers standard.
 - b. Floor Slope Build:
Tnemec Series 215 Surfacing Epoxy (where indicated).
 - 1) Mix with Portland cement, aggregate and dry silica as recommended by manufacturer.
 - b. Waterproofing Membrane:
Tnemec Series 206 Sub-Flex @ 40 – 50 sq ft per gallon.
 - 1) Formulation Description: 100 percent solids.
 - c. Primer (Slurry Coat):
Tnemec Series 245 Ultra Tread S, three-component, polyurethane modified concrete at 25-28 sq. ft. per kit (3/16").
 - d. Broadcast:

Tnemec Broadcast Series 222 decorative quartz into wet Series 245 to refusal.

- e. Coved Base:
 - Tnemec Series 243 Ultra Tread aggregate mortar to form a rolled radius cove.
 - 1) 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 instructions.
- f. Grout Coat:
 - Tnemec Series 284 Deco Clear at 85-125 sq. ft. per gallon, applied at a film thickness of 14 – 18 dry mils.
- g. Pigmented Urethane Gloss Finish (Topcoat):
 - Tnemec Series 248 Everthane, three-component, aliphatic moisture cured urethane finish coat(s), applied at a film thickness of 2.0 – 3.0 dry mils.
- h. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated.
 - 1) Compressive Strength: 10,000 psi per ASTM C 579.
 - 2) Tensile Strength: 2,250 psi per ASTM C 307.
 - 3) Flexural Strength: 4,000 psi per ASTM C 580.
 - 4) Water Absorption: 0.01% per ASTM C 413.
 - 5) Coefficient of Thermal Expansion: No more than 1.3E-05 linear coefficient of thermal expansion per degree F per ASTM C 531.
 - 6) Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch (1.6-mm) permanent indentation per MIL-D-3134.
 - 7) Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) per MIL-D-3134.
 - 8) Abrasion Resistance: 66 ms maximum weight loss per ASTM D 4060.
 - 9) Flammability: Self-extinguishing per ASTM D 635.
 - 10) Hardness: 85-90, Shore D per ASTM D 2240.
 - 11) Adhesion: 400 psi or greater, 100 percent concrete failure per ASTM D 4541.

- D. **System EIFS-1X for application on Exterior EIFS:** (for Exterior EIFS Walls)
 - a. To be issued by Addendum.

END OF SECTION 09 96 00

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. Division 09 "Painting" section for general field painting.
 - 2. Division 09 "Resinous Flooring" section 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
 3. Desco
 4. Or approved equal
- 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 Tneme-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 Tneme-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, convector 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. Contractor 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 13 - METAL 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. Painted steel toilet compartments configured as toilet enclosures and urinal screens.

- B. Related Requirements:

- 1. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

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

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

- B. Shop Drawings: For toilet compartments.

- 1. Include plans, elevations, sections, and attachment details.
- 2. Show locations of cutouts for compartment-mounted toilet accessories.
- 3. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
- 4. Show locations of centerlines of toilet fixtures.
- 5. Show locations of floor drains.
- 6. 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.
 - 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** door bumper(s) with associated fasteners.
 - 4. Door Pull: **One** door pull(s) with associated fasteners.
 - 5. Fasteners: **10** 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. 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 PAINTED STEEL TOILET COMPARTMENTS

- A. Toilet-Enclosure Style: **Floor anchored**
- B. Entrance-Screen Style: **Floor anchored**
- C. Urinal-Screen Style: **Wall hung, flat panel**
- D. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
 - 1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of **1 inch (25 mm)** for doors and panels and **1-1/4 inches (32 mm)** for pilasters.
 - 2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand applied downward

load on grab bar of at least 250 lbf (1112 N), when tested according to ASTM F446, without deformation of panel.

3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

E. Urinal-Screen Construction:

1. Flat-Panel Urinal Screen: Matching panel construction.
2. Integral-Flange, Wall-Hung Urinal Screen: Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.
3. Wedge-Shaped, Wall-Hung Urinal Screen: Similar to panels, V-shaped, fabricated for concealed wall attachment, and maximum 6 inches (152 mm) wide at wall and minimum 1 inch (25 mm) wide at protruding end.

F. Facing Sheets and Closures: **[Electrolytically coated steel] [or] [hot-dip galvanized-steel]** sheet with nominal base-metal (uncoated) thicknesses as follows:

1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).
2. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.048 inch (1.21 mm).
3. Panels: **Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm)**
4. Doors: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
5. Flat-Panel Urinal Screens: Thickness matching the panels.
6. Integral-Flange, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
7. Wedge-Shaped, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).

G. Pilaster Shoes and Sleeves (Caps): Stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

H. Urinal-Screen Post: Manufacturer's standard post design of **material matching the thickness and construction of pilasters or 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish**; with shoe **and sleeve (cap)** matching that on the pilaster.

I. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets; **stainless steel**
2. Full-Height (Continuous) Type: Manufacturer's standard design; **stainless steel**

J. Steel Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply with coating manufacturer's written instructions for applying and baking.

1. Color: **As selected by Architect from manufacturer's full range**
 - a. Allow for application of **one color** in each room.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: **Stainless steel**
2. Hinges: Manufacturer's standard allowing emergency access by lifting door.
3. Latch and Keeper: Manufacturer's standard **surface-mounted** latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide

- units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors **and entrance-screen doors**.
 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. 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 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 **and entrance-screen 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.
- C. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- D. 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 B26/B26M.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M).
- C. Brass Castings: ASTM B584.
- D. Brass Extrusions: ASTM B455.
- E. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
 1. Electrolytically Zinc Coated: ASTM A879/A879M, 01Z (03G).
 2. Hot-Dip Galvanized: ASTM A653/A653M, either hot-dip galvanized or galvanized.
- F. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- G. Stainless Steel Castings: ASTM A743/A743M.

- H. Zamac: ASTM B86, commercial zinc-alloy die castings, chrome plated.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.
- E. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- F. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at **tops and** bottoms of posts. Provide shoes **and sleeves (caps)** at posts to conceal anchorage.
- G. 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 substrates, 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.
- C. Coordinate layout and installation of supports, inserts, and anchors built into other units of work for toilet compartment anchorage.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.

1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch (13 mm).
 - b. Panels and Walls: 1 inch (25 mm).
 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than **three brackets attached at midpoint and** near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 3. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
- E. Floor-and-Ceiling-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.
- F. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

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 **and doors in entrance screens** to return doors to fully closed position.

END OF SECTION 10 21 13

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. See Section 08 83 00 "Mirrors" for frameless mirrors.

1.2 SUMMARY

- A. Section Includes:
 - 1. Surface-Mounted Paper Towel Dispenser.
 - 2. Surface-Mounted Liquid Soap Dispenser.
 - 3. Stainless Steel Surface-Mounted Multi-Roll Toilet Tissue Dispenser.
 - 4. Stainless Steel Surface-mounted Sanitary Napkin Disposal.
 - 5. Grab Bar: Satin-Finish Stainless Steel, 1-1/2" (38 mm) diameter.
 - 6. Stainless Steel Shower Curtain Rod, Hooks and Shower Curtain.
 - 7. Towel / Clothes Hook.
- B. Related Requirements:
 - 1. Section 08 83 00 "Mirrors" for frameless mirrors.

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

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 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.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 SURFACE-MOUNTED PAPER TOWEL DISPENSER (PTD-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 by Addendum during the bidding period.

- C. Bobrick Washroom Equipment, Inc., Fino Collection™ Series Surface-Mounted Paper Towel Dispenser, Product #B-9262.
 - 1. Finish: Satin-Finish Stainless Steel. Dispenses 400 C-fold or 525 multi-fold towels. Dimensions: 11-11/16" W x 13-7/16" H, extending 3-5/16" from wall.
 - 2. Provide Manufacturer's service and parts manual to the building owner/manager.

2.3 SURFACE-MOUNTED LIQUID SOAP DISPENSER (SD-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 by Addendum during the bidding period.
- C. Bobrick, Classic Series™ Series Surface-Mounted Soap Dispenser, Model B-2111.
 - a. Finish: Satin-Finish Stainless Steel. Dispenses all-purpose hand soap, capacity of 40-fl oz.
 - b. Dimensions: 4-3/4" W x 8-1/8" H, extending 3-1/2" from wall.

2.4 STAINLESS STEEL SURFACE-MOUNTED MULTI-ROLL TOILET TISSUE DISPENSER (TTD-2)

- 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 by Addendum during the bidding period.
- C. Bobrick Washroom Equipment, Inc., ConturaSeries® Surface-mounted Multi-Roll Toilet Tissue Dispenser, Product #B-4288.
 - 1. Finish: Satin-Finish Type #304 Stainless Steel. Surface-mounted Multi-Roll Toilet Tissue Dispenser shall be type 304 stainless steel with all welded construction, including dispensing mechanism, inner housing, and cam; exposed surfaces shall have satin finish. Front of toilet tissue dispenser door shall be drawn, one-piece, seamless construction. Door shall be secured to cabinet with two rivets and equipped with a flush tumbler lock keyed like other Bobrick washroom accessories. Unit shall dispense two standard-core toilet tissue rolls up to 5-1/4" (133 mm) diameter (1800 sheets). Extra roll shall automatically drop in place when bottom roll is depleted. Unit shall be equipped with two theft-resistant heavy-duty, one-piece, molded ABS spindles. Install per manufacturer's written instructions.

2.5 STAINLESS STEEL SANITARY NAPKIN DISPOSAL (SND-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 by Addendum during the bidding period.
- C. Bobrick Washroom Equipment, Inc., ConturaSeries® Surface-mounted Sanitary Napkin Disposal, Product #B-270.
 - 1. 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.
 - a. 18" Shelf: #B-295x18.

2.6 GRAB BARS (GB-1, GB-2, GB-3)

- 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 by Addendum during the bidding period.
- 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.
 - a. 24" Grab Bar: #B-6806.99x24.
 - b. 36" Grab Bar: #B-6806.99x36.
 - c. 48" Grab Bar: #B-6806.99x48.

2.7 STAINLESS STEEL SHOWER CURTAIN ROD, HOOKS & SHOWER CURTAIN (SCR-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 by Addendum during the bidding period.
- C. Bobrick, Classic Series™ Heavy-Duty Shower Curtain Rod, Model B-6107.
 - 1. Finish: Type 304 Stainless Steel (20-gauge), Satin-Finish.
 - 2. Dimensions: 1" diameter rod with 2-1/2" square flange at each end. Reference floorplan for length(s) required.
- D. Bobrick, Shower Curtain Hooks, Model 204-1, for use on 1" diameter curtain rods.
 - 1. Finish: Type 304 Stainless Steel.
- E. Bobrick, Shower Curtain, Models 204-2 & 204-3.
 - 1. Finish: Opaque, matte white vinyl, .008" thick, containing antibacterial and flame retardant agents. White HDPE grommets along top, every 6". Hemmed bottom and sides.
 - 2. Dimensions: 204-2 model is 42" W x 72" H. 204-3 model is 70" W x 72" H, reference floorplan for width(s) required.

2.8 TOWEL / CLOTHES HOOK (TH-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 by Addendum during the bidding period.
- C. Bobrick Washroom Equipment, Inc., Model #B-76727 Double Robe Hook.
 - 1. All-welded, 18-8 S, Type 304, 22 gauge (0.8mm) stainless steel Flange and Support Arm, projecting 2" (50mm) from wall. Mounting shall be with a concealed bracket, 18-8 S, Type 304, 18 gauge (1.2mm) stainless steel; secured to wall plate with a stainless-steel setscrew and include a Concealed Wall Plate. Install per manufacturer's written instructions. Finish: Satin stainless steel.

2.9 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. 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 10 60 05 – WIRE MESH PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the manufacturing of wire mesh partitions as indicated on drawings and as specified including General and Supplementary Conditions of the Contract and Division 01.

1.2 SUBMITTALS

- A. Product Data for product specified consisting of manufacturer's specifications, technical data and color samples.
- B. Shop Drawings showing fabrication and installation of wire mesh partitions. Include plans, elevations and large scale details.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: Engage a firm specializing in manufacturing products specified with minimum 5 years documented experience.
- B. Field Measurements: Confirm field measurements before fabrication, where possible. Allow for adjustments and fittings where required.

PART 2. PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering products which may be incorporated in the work include the following:
 - 1. Miller Wire Works, Inc., Birmingham, AL
Website: www.millerwireworks.com
 - 2. Anchor Fence Division, Anchor Post Products Inc.
 - 3. U.S. Steel Supply Division, U.S. Steel Corp.
 - 4. Allied Tube & Conduit Corporation
 - 5. Or equal, as specifically approved by Architect by Addendum during the bidding period.

2.2 MATERIALS

- A. Wire Mesh and Partition Frame:
 - 1. Steel: Complies with ASTM A36/A36M.
 - 2. Mesh: #6 W&M gauge steel wire, 2" diamond intercrimp mesh, clinched and welded to channel frames.
 - 3. Vertical Frames: 1-1/2" x 3/4" channel with 3/8" bolts at 15" o.c.

4. Horizontal Frames: 1-1/2" x 3/4" channel.
5. Stiffeners: (2) 1-1/4 x 5/8" 'c' type channel bolted together.
6. Top Capping Bar: Hot roll formed 'C' shaped channel C3 x 4.1.
7. Flat Bar Stiffeners: 2 1-2" x 3/8" flat bar intermediate post with 2 1/2" high ductile iron floor sockets.
8. Corner Posts: 1-3/4" x 1-3/4" x 1/8" 90° angle.
9. All hardware and anchors are furnished for a complete installation.

B. Door and Frame:

1. Doors:
 - a. Sliding: Constructed of 1-1/2" x 3/4" channel frame with 1/8" x 1-1/2" flat bar top and sides. Door to have (2) four-wheel hangers with box track.
2. Bracing: 3" x 4.1 lb. channel brace with 8" x 16" x 1/4" base plate and mounting anchors.
3. Locks: Doors are equipped with mortise type cylinder locks operated from outside with key, and from inside with recess knob. Padlock hasps also available.

C. Finish: Dipped in cleaning bath and painted one coat of enamel from standard colors.

PART 3. EXECUTION

3.1 EXAMINATION

- A. Examine the areas and conditions under which mesh partition units are to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install Work under this Section in accordance with manufacturer's printed recommendations.
- B. Erect partitions plumb, rigid, properly aligned, and securely fastened in place. Adjust opening and closing units to operate freely without bind.
- C. Provide additional field bracing as necessary for rigid, secure installation.
- D. Install all accessories required for a completed installation.
- E. Touch up paint damaged finish after completion of installation using field-applied paint to match color of shop-applied finish.

END OF SECTION 10 60 05

SECTION 11 05 12 - GENERAL MOTOR REQUIREMENTS FOR EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of motors.

1.2 RELATED WORK

- A. Section 26 05 00, ELECTRICAL GENERAL PROVISIONS: General electrical requirements that are common to more than one Section of Division 26.
- B. Section 26 29 13, MOTOR CONTROLLERS: Starters, control and protection for motors.
- C. Division 11: Other sections specifying motor driven equipment in.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTALS
- B. Shop Drawings: Show dimensions, method of assembly, installation and conditions relating to adjoining work which requires cutting or close fitting, reinforcement, anchorage, and other work required for complete installation.
- C. Operating Instructions: In accordance with requirements in Section 01 33 00 SUBMITTALS and Section 00 72 13 GENERAL CONDITIONS.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Electrical Manufacturers Association (NEMA):
 - MG 1-2016Motors and Generators
 - MG 2-2014Safety Standard and Guide for Selection, Installation and Use of Electric Motors and Generators
- C. National Fire Protection Association (NFPA):
 - 70-2020National Electrical Code (NEC)

PART 2 - PRODUCTS

2.1 MOTORS

- A. For alternating current, fractional and integral horsepower motors, NEMA Publications MG 1 and MG 2 shall apply.
- B. Minimum voltage ratings shall be as follows:
 - 1. Single phase:
 - a. Motors connected to 120-volt systems: 115 volts.
 - b. Motors connected to 208-volt systems: 200 volts.
 - c. Motors connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
 - 2. Three phase:
 - a. Motors connected to 208-volt systems: 200 volts.
 - b. Motors, less than 74.6 kW (100 HP), connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
 - c. Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.
 - d. Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.
 - e. Motors connected to high voltage systems: Shall conform to NEMA Standards for connection to the nominal system voltage shown on the drawings.
- C. Number of phases shall be as follows:
 - 1. Motors, less than 373 W (1/2 HP): Single phase.
 - 2. Motors, 373 W (1/2 HP) and larger: Three phase.
 - 3. Exceptions:
 - a. Hermetically sealed motors.
 - b. Motors for equipment assemblies, less than 746 W (one HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.
- D. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.
- E. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.
- F. Motor Enclosures:

1. Shall be the NEMA types shown on the drawings for the motors.
2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed.
3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

G. Additional requirements for specific motors, as indicated in other sections, shall also apply.

H. Energy-Efficient Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 Watts or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

- I. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.
- J. Premium efficiency motors shall be used where energy cost/kW x (hours use/year) > 50.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motors in accordance with manufacturer’s recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

3.2 FIELD TESTS

- A. Conductor insulation resistance testing shall be performed using a megohmmeter (megger) for all motors after installation and before start-up. Results of tests shall be published for engineer and authority having jurisdiction review. All motor conductor tests shall show ungrounded.

END OF SECTION 11 05 12

SECTION 11 40 00 - FOOD SERVICE EQUIPMENT

1. PROJECT SCOPE

The Work of the FSEC consists of furnishing all plant labor, equipment appliances, material, and performing all operations in connection with the installation of all food service equipment in strict accordance with the specifications and applicable drawings for the project referenced above. The Work of the FSEC shall include, but not be limited to the following:

- A. The FSEC shall hold all equipment in storage until construction is ready to receive the work of this contract. All Work under this contract must be complete by October 2022.
- B. All items of equipment shall be delivered and set in place during regular working hours, ready for mechanical and electrical connections, which will be made by others. The FSEC shall be responsible for coordinating their work with the General Contractor and all Mechanical and Electrical Contractors.
- C. All work involved in making stands and supports for all equipment as required and cutting of equipment holes for pipes, drains, etc., required for the installation.
- D. Repair all damage done to the premises as a result of this installation and the removal of all debris left by those engaged in this installation.
- E. All food service equipment and fixtures shall be clean and ready for use at the time the Project is turned over to the Owner.
- F. Material and equipment shall be new and the best of its respective kind, unless otherwise specified. The FSEC shall repair, refinish or replace any equipment damaged in transit or during installation, to the satisfaction of Owner.
- G. Plumbing and electrical trim and connections to utilities are to be furnished by the respective trades involved. Final utility connections shall be made by the General Contractor's subcontractors and are not a part of the FSEC Work.
- H. Installation of fixtures and equipment and all final fittings, etc., shall be done in a neat and workmanship like manner by competent, experienced craftsmen in their respective fields. Final installations such as sealants and close-tolerant adjustments shall be made by the FSEC.
- I. Utility rough-in drawings shall be provided to the General Contractor within **60 days** after Food Service contract is awarded.

NOTE: Food Service Contractor must have personnel available to coordinate rough-in locations with the on-site Contractors when needed.

2. BIDDING REQUIREMENTS & INFORMATION

- A. The FSEC shall have been in business for a minimum of ten (10)years.
- B. The Work of this Contract shall be bid and performed under contract with the owner.

3. DEFINITIONS:

- A. The term "Owner" shall mean the person; firm or corporation named in the specifications and shall be deemed to include all duly authorized representatives thereof.

- B. The term "Consultant" shall mean the owner-designated Food Service Consultant, or their duly authorized representatives.
- C. The term "FSEC" shall mean Food Service Equipment Contractor acting as prime contractor or the fixtures and equipment.
- D. The term "Fabricator" shall mean the person, firm or corporation fabricating the custom-built items indicated on the plans and specifications, as a subcontractor of the FSEC.
- E. The term "Subcontractor" includes any person, firm or corporation furnishing labor or material, or both, for the Fabricator, and/or FSEC.
- F. The term "General Contractor" shall mean the person, firm or corporation and their authorized representatives who are under contract with the Owner for the construction of the facility in conformance with the plans and specifications issued by the Architect. The General Contractor will provide labor and material for rough-in and final connection of utilities to equipment. They will not coordinate the work.

4. CONTRACT DOCUMENTS

The Contract Documents are complementary and what is called for by anyone shall be as binding as if called for by all, it being the intent of the Contract to include all work required to complete the equipment installation as indicated therein, excepting only that work which is explicitly mentioned or indicated as omitted from the Contract.

5. FABRICATOR'S RESPONSIBILITY

The Fabricator shall verify at the structure and site all measurements indicated on the drawings and shall establish correctly all lines, levels, and positions for all parts of the work. The Fabricator shall be responsible for all work done under this Contract, including faulty or improper work of Subcontractors and others under him by Contract or otherwise. The Fabricator shall be responsible for the conduct of his employees and agents on the site and shall maintain good order on the premises where work on the project is carried on.

It is not incumbent upon the Owner and/or FSEC to notify the Fabricator to attend to or have in readiness such work or material as operations may require, it being deemed that the Fabricator shall be responsible for all delays caused by the neglect of himself or those under him by Contract or otherwise.

The Owner and/or FSEC reserve the right to employ other contractors for work in connection with this project. The Fabricator shall afford the other contractors access to areas in which he is working and reasonable opportunity to carry out their work so that progress of construction will not be delayed.

Where Fabricator unnecessarily cuts, damages or removes work of other contractors, or through negligence fails to notify others regarding space requirements for his/her work, or gives incorrect information or dimensions regarding same, said Fabricator shall be fully responsible for correcting at his/her own expense any damaged or incorrect work caused by his acts or omissions.

In all cases where Fabricator causes or is alleged to have caused damage to any other contractor, the Fabricator shall settle all claims against him/her. If any contractor sues the Owner and/or FSEC for damages alleged to have been sustained because of the Fabricator's work, the Fabricator shall defend such proceedings, satisfy any judgment awarded, and pay all expenses arising because of such action.

6. SUBCONTRACTORS

Every Subcontractor shall be bound by the terms and provisions of the Contract Documents as applicable to his/her work. Nothing contained herein shall create any contractual relation between any Subcontractor and the Owner or his/her Agent.

The Fabricator shall be fully responsible to the Owner and/or FSEC for the acts and omissions of his Subcontractors.

7. PERMITS AND CERTIFICATES

FSEC and/or its Fabricators and/or the Subcontractors shall give all notices required by law and comply with all laws, ordinances and regulations bearing on the conduct of the work as drawn and specified. Any work upon which an Inspection Certificate or permit by local authorities, national board of fire underwriters, and/or any governing body is required, such Inspection Certificate or Certificates or permits shall be obtained by FSEC, its Fabricators, and/or the Subcontractors, and shall be paid for by the entity designated by FSEC.

FSEC and/or the Fabricators and/or the Subcontractors shall procure all necessary Certificates of Acceptance or of Completion as are required and issued by the state, municipal or other authorities and deliver same to Owner.

8. LAWS AND ORDINANCES

All work and materials shall comply with all applicable federal, state and municipal laws, codes and ordinances (including those set forth by the Health Department), and any and all regulations and/or directions of Inspectors appointed by proper authorities having jurisdiction. In any event that the conditions of the specifications violate the code of any industry, then such code conditions shall prevail. FSEC shall so state in his specifications or proposals where the code is at variance with these specifications. Electrical units shall be either Underwriters Laboratories approved or of equal approval by local agencies.

9. ACCESS, AUTHORITY AND STOPPAGE

Representatives of the Owner shall have access at all times during the progress of the work to any place where the work is being performed, and the FSEC shall provide sufficient and proper facilities for their inspection of the work or materials. The aforementioned representatives shall have the right to inspect all materials and work and to reject same if in their judgment they are not in conformity with the drawings and specifications. All rejected work or materials shall be immediately replaced to conform to the drawings and specifications. The aforementioned representatives shall have the right to order the work of the FSEC, or any Fabricator or Subcontractor wholly or partially stopped if, in their judgment, the materials furnished or the work being done is not in strict accordance with the provisions and specifications; or until any objectionable person or material is removed from the premises, and shall have the right to declare the Contract forfeited for non-performance when not being executed according to the intent and meaning of the Contract, drawings and specifications.

Such stoppage, suspension or forfeiture shall not in any way invalidate any other terms of the Contract and no extra charges shall be made.

10. MATERIALS AND APPLIANCES

Unless otherwise stipulated, FSEC, their Fabricators, and/or Subcontractors shall provide and pay for all materials, and labor, tools, equipment, transportation, and other facilities necessary for the execution and completion of the work. The Contractor for general construction shall furnish and provide the following:

- A. Temporary power and light as may be required to facilitate the installation of the equipment, and reasonable openings and storage space to permit convenient delivery of the equipment.
- B. FSEC shall check conditions at the building, particularly openings and passages, so that he does not build any items too large. Any such pieces that are too bulky for existing facilities are to be hoisted and/or otherwise handled with proper apparatus to be paid for by this Fabricator/Subcontractor.

11. ERRORS, AMBIGUITIES AND OMISSIONS

Any errors, ambiguities and omissions in drawings and specifications shall be reported to the Consultant and/or his agent for correction before any part of the work involved is started. Unless otherwise expressly stipulated, no additional allowances will be made in the Fabricator's favor because of errors, ambiguities and/or omissions which should reasonably have been discovered by him/her during the preparation of his/her bid estimate and directed to the attention of the Consultant and/or his Agent in a timely manner. The written decision of the Consultant will be final.

12. PATENT ROYALTIES, FEES AND LICENSES

FSEC, its Fabricators and Subcontractors shall pay all royalties and license fees. All patent royalties, fees and licenses made necessary by the use of patented methods of construction, appliances, equipment or devices in the work shall be paid by FSEC who shall defend, indemnify, and save harmless, the Owner and FSEC against any and all claims of those holding or claiming to hold letters patent covering features of construction, appliances, equipment or devices, so used. No patent or patent pending article, method or device which required the payment of any license fee or royalty in addition to the purchase price shall be used in the work of Equipment Contractor without the prior approval of the Owner and/or his Agent.

13. SIGNS

No signs or nameplates of any type shall be allowed to be displayed on any part of this work or on or about the Owner's premises unless so authorized in writing by the Owner and/or his Agent.

14. CUTTING AND FITTING

The FSEC shall be responsible for performing all cutting and fitting that may be required for the installation of the equipment under this Contract. Should it be necessary to cut, fit or otherwise modify materials and finishes that were installed by the General Contractor, the FSEC shall inform the General Contractor of such occurrence. The FSEC and General Contractor shall agree to the payment of the subsequent refinishing as necessary, with no additional cost to the Owner.

15. PATCHING

FSEC and/or its Fabricators and/or the Subcontractors shall be liable and responsible for any patching required by reason of his work, and as caused by the negligence of his/her employees. Patches of any kind so required will be repaired and charged to him/her.

16. TRADE UNIONS

All work to be performed in connection with this Contract shall be done by workmen or firms whose employees are not objectionable in any way to the various trade unions in the construction of the premises. FSEC, its Fabricators and the Subcontractors shall be wholly responsible for all trade union relations and the Owner and/or his/her Agent shall not be liable in any way through delays or claims arising through such causes.

17. SECURITY

All appliances and small equipment received at the job site are to be secured in a lockable area as acceptable by the Owner, the Owner's Representative, the General Contractor, or the designated authority.

DIVISION II - EQUIPMENT PROVISIONS

1. REFERENCES

- A. ANSI/ASTM A167 - Stainless and Heat-resisting Chromium-nickel Steel Plate, Sheet and Strip.
- B. ANSI/AWS D1.1 - Structural Welding Code.
- C. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- D. FS DD-G-451 - Glass, Float or Plat, Sheet, Figured (Flat for Glazing, Mirrors, and other Uses).
- E. FS DD-G-1403 - Glass, Plate (Float), Sheet, Figured, and Spandrel (Heat Strengthened and Fully Tempered).

2. QUALITY ASSURANCE

- A. **Manufacturer's Qualifications:** Firms regularly engaged in the manufacture of food service equipment of types, capacities, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Fabricator's Qualification:** Where indicated that units require custom fabrication, provide units fabricated by shops which are skilled and with a minimum of 5 years of experience. Where work cannot be fully shop-fabricated, complete fabrication on work at project site.

3. REGULATORY REQUIREMENTS

NSF Standard: Comply with applicable National Sanitation Foundation (NSF) standards and recommended criteria. Provide each principal item of food service equipment with a NSF "Seal of Approval".

UL Labels: Where available, provide UL labels on prime electrical components of food service equipment. Provide UL "recognized marking" on other items with electrical components, signifying listing by UL, where available.

ANSI Standards: Comply with applicable ANSI standards for electric powered and gas-burning appliances, and for plumbing fittings including vacuum breakers and air gaps to prevent siphonage in water piping.

NFPA Codes: Install food service equipment in accordance with the following National Fire Protection Codes (NFPA) Codes:

NFPA 54 - National Fuel Gas Code.

NFPA 70 - National Electrical Code.

NFPA 96 - Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.

4. DRAWINGS

- A. Drawings which constitute a part of this section indicate the general arrangement and location of fixtures and equipment.

Should it be necessary to deviate from the arrangements indicated, such deviations shall be made without expense to the Owner. The data given herein and on the drawings are as exact as could be secured, but their extreme accuracy is not guaranteed. The drawings and specifications are for the assistance and guidance of FSEC and the exact locations, distances, and levels will be governed by the building. FSEC shall accept this Contract with this understanding.

- B. The drawings and specifications are complementary, and the requirements of one shall be as binding as if required by both. FSEC shall comply with the true intent and meaning of these documents taken as a whole, and shall not avail himself of manifest errors and/or omissions to the detriment of the work. Figure dimensions shall take precedence over scale measurements, detail drawings over general drawings, and drawings of later date over those of earlier date. In a like manner, addenda to specifications take precedence over original specifications and earlier addenda thereto.
- C. FSEC shall be responsible for checking the accuracy of the location of all plumbing, refrigeration, and electrical connections and outlets in electrical connections and outlets in connection with his work. Required voltages, cycles and phase, and electrical requirements shall be checked before ordering equipment.

5. SUBMITTALS

- A. FSEC shall submit Food Service Equipment shop drawings and manufacturer's product data for all items which are a part of this contract. Shop drawings shall be routed through the General Contractor.
- B. It shall be the responsibility of the FSEC to furnish a Final Rough-In Plan to the General Contractor, and to coordinate the final connection of all equipment items furnished in this contract. Final Rough-In Plan shall indicate vertical and horizontal dimensions, and show all mechanical and electrical requirements. The FSEC shall verify, confirm and note all utility requirements for all equipment items as part of the Final Rough-In Plan. Rough-in locations for existing equipment, to be furnished by the Owner, shall be included on this Rough-In Plan. The Owner will furnish specific utility requirements.
- C. Shop drawings shall be made to indicate accurate job conditions and dimensions and to conform to the requirements of the plans and specifications, supplementary details and instructions and shall indicate all dimensions and details of fabrication and installation.
 - a. Also to be indicated are all reinforcements, connections, supports, anchorages, and other features of construction, together
 - b. with all clearances required in the work of others and relation of work as detailed to finish surfaces of abutting work.
 - c. For appliances, indicate configuration, sizes, materials, finishes, locations of utility connection and locations.
 - d. For control systems, indicate service connections, characteristics, and wiring diagrams.
- D. These shop drawings shall be prepared and submitted to the Consultant for approval well in advance of the time information will be required in order that work will not be delayed.
 - a. Approval of such drawings shall not relieve FSEC from responsibility for any deviations from the drawings and specifications, unless such deviations are approved in writing by the Owner or his Agent.
- E. Two copies of each such drawing shall be submitted for preliminary checking. If corrections are unnecessary, two additional copies shall be submitted for final approval. FSEC shall furnish all additional copies of shop drawings as required to correlate the work of other trades involved.

6. DELIVERY, STORAGE & HANDLING

- A. Whenever possible, work shall be fabricated and finished in the shop and delivered complete to the job site ready to set in place.
- B. FSEC shall deliver equipment on schedule, and coordinate his work with the General Contractor. FSEC shall cooperate with all trades to ensure a satisfactory installation.
- C. Deliver food service equipment in factory-fabricated containers designed to protect equipment and finish until installation. Make arrangements to hold in warehouse until delivery can be made to job site. The FSEC shall be responsible for inspecting all equipment for hidden damages upon delivery, and notifying the freight company and manufacturer for replacement of all damaged equipment, prior to delivery to the project.

Store food service equipment in original containers, and in location to provide adequate protection to equipment while not interfering with other construction operations.

Handle food service equipment carefully to avoid damage to components, enclosures, and finish. Do not install damaged food service equipment; replace and return damaged components to equipment manufacturer.

Store products clear of floor in a manner to prevent warping, twisting, or sagging.
- D. Coordinate with the General Contractor the size of access and route to place of installation.

7. CLEAR AWAY

The FSEC shall be responsible for uncrating all materials and appliances under this contract. The rubbish and debris resulting from work of the FSEC shall be cleared away from time to time and the site maintained in a clean and orderly condition at all times. The FSEC shall procure the necessary trash receptacle(s) to contain the debris, and shall pay for all hauling costs to remove it from the project site. Upon completion of the work, all tools, appliances, equipment and surplus material shall be removed from the premises and, unless otherwise directed, the finished work left in a neat, clean and serviceable condition acceptable to the Owner and/or his/her Agent.

8. GUARANTEE & WARRANTY

- A. All equipment and fixtures furnished by this FSEC shall be guaranteed for a period of one (1) year from date of final acceptance by Owner, unless otherwise noted. A Service Contract shall provide for 24 hour service during this period. Prior to start-up, final acceptance and payment, Contractor shall provide a copy of Service Contract and affix the necessary service decals to all equipment covered under aforementioned contract. Guarantees shall cover any defects of material or workmanship when operated under normal conditions, and shall be repaired or replaced at no cost to the Owner. All repairs and replacement shall be made at a time and at hours satisfactory to the Owner.
- B. Warranty shall include coverage of scheduled equipment, including disconnection of defective unit, and connection of replacement unit.
- C. All warranties shall become effective on date of startup and final training by Owner, not shipping date.
- D. FSEC shall be responsible for the satisfactory operation of all assembled equipment. Tests of the installed equipment shall be required. Defects or deficiencies noted as a result of tests shall be corrected to the entire satisfaction of the Owner and/or his Agent at the expense of the Manufacturer.

9. SPECIAL REPORTS

Certification of asbestos-free products: The FSEC shall submit to the Owner a written certification from all suppliers that the products to be supplied are free of asbestos. This certification shall be in letter form on the supplier's letterhead. This must be received by the Owner before any payment to FSEC will be made. In the event the FSEC is unable to produce said certification, he/she will remove the item from the Owner's premises at no cost to Owner. The Owner then reserves the right to bill the FSEC for any or all consequential damages resulting for his/her inability to provide certification.

10. ACCEPTABLE FABRICATORS/MANUFACTURERS

- A. Custom stainless steel or other metal fabrications where indicated, shall be furnished by one of the following fabricators:
1. Nichols Custom Stainless Mfg.
8500 NE Underground Drive
Pillar 107
Kansas City, MO 64161
 2. Two Rivers Enterprises
490 River Street West
Holdingford, MN 56340
320-746-3156
 3. Missouri Equipment Co.
2222 No. 9th Street
St. Louis, MO
314-621-0144
 4. St. Louis Stainless Services
615 Rudder Road
Fenton, MO
888-507-1578
- B. These specifications are based on specific brands and models, unless otherwise stated. All bidders must bid the specified manufacturer and model. Substitutions are not permitted.

11. MANUFACTURER'S DIRECTIONS

Manufacturers' directions shall be followed in all cases where the manufacturers of articles used in this Contract furnish directions or prints covering points not shown on the drawings or specifications.

- A. All work materials shall be in full accordance with the latest rules of the National Board of Fire Underwriters, any local or state ordinances, and the regulations of the State Fire Marshal; and with any prevailing rules and regulation pertaining to adequate protection and/or guarding of any moving parts or otherwise hazardous location.
- B. All electrically operated and/or heating equipment fabricated or otherwise shall conform to the latest standards of the National Electric Manufacturers Association and of the Underwriters Laboratories, Inc., where applicable standards have been set up by the agency or otherwise such as to be acceptable to authorities having jurisdiction.
- C. Whenever the drawings and specifications required larger sizes or higher standards than are required by the regulations, the drawings and specifications shall govern.

- D. Whenever the drawings and specifications require something which will violate the regulations, the regulations shall govern and the FSEC shall notify the Consultant immediately.
- E. No extra charge will be paid for furnishing items required by the regulations but not specified or shown on the drawings.
- F. Rulings and interpretations of the enforcing agencies shall be considered a part of the regulations.

12. ELECTRICAL REQUIREMENTS

- A. Motor starters shall be provided as an integral part of the equipment in an accessible location, or for mounting in an approved location on or adjacent to the equipment. The starters shall be connected to the motors and other controlled parts on the equipment as an obligation under this section. Starters shall be for across the line start with thermal overload protection. Push-button stations shall be mounted in the starter covers, except where otherwise indicated.
- B. Line connection to motor starters shall be made by the General Contractor, including the providing of conduits, outlets, disconnect switches, wire and related items.
- C. Sheet metal fabricator shall provide and locate all outlet boxes and junction boxes where such boxes are mounted on and are part of the fixture. Wherever access is not available for the electrical contractor to run his lines from junction boxes to end usage in fixture, the sheet metal fabricator is to supply and install suitable conduit for the running of such lines.

13. GAS CONNECTION & REGULATOR REQUIREMENTS

- A. The FSEC shall furnish flexible, quick-disconnect hose connections and regulators for each gas appliance, **whether new or existing**. Include restraint cables as required by code at all movable appliances. Where regulators are not integral with the appliance, furnish separate regulators for installation by the plumbing contractor. Refer to Equipment Schedule for item number & specification. Hose connection shall be SwiveLink as manufactured by T&S Brass and Bronze Works, Inc.
- B. The FSEC shall furnish Caster Cradle wheel replacement devices as manufactured by Eagle at all items of cooking equipment (new or existing) with casters located under an exhaust hood.

14. PLUMBING REQUIREMENTS

- A. Beverage equipment vendors shall provide backflow preventers at all equipment. The Plumbing Contractor shall install preventers and all other items to all beverage equipment.
- B. The Plumbing Contractor shall be responsible for the installation of all faucets, drains and disposers to sinks and dishtables regardless of who is furnishing the plumbing fixtures.

15. MATERIALS

- A. Stainless Steel: Stainless Steel to be U.S. standard gauges with a chemical analysis of approximately 18% chromium, 8% nickel, and not more than 0.12% carbon, Armco Type #304, or equal, free from all pits and imperfections. All stainless steel shall be #4 grind minimum, unless otherwise noted, finished on exposed and/or working sides after fabrication.
- B. Sheet Steel: ASTM A446; 1.25 oz./sq. ft. galvanized coating.
- C. Soldering: Soldering, where exposed to wet food, drinking water, and/or beverages, shall be non-toxic type, 95% tin or better.

- D. Gaskets: Gaskets for low temperature seal to be replaceable extruded or molded live rubber of such nature so as not to absorb moisture or harden at low temperatures. Gaskets to be shaped with flat mounting surfaces and sealed to prevent harborage of vermin.
- E. Service Outlet covers and Escutcheons: Stainless steel.
- F. Sealants: ASTM C920; Type S Grade NS, Class 25, Use NT. Provide sealants that when fully cured and washed meets requirements of the FDA Regulation 21 CFR 177.2600 and NSF Std 051 for Food zone Use. Sealant shall be Kason 3700 Series Rubbaseal Silicone or equivalent. Use aluminum color when sealing stainless steel components to adjacent surfaces.

16. OPERATIONAL & MAINTENANCE DATA

- A. Operational Instructions: FSEC shall provide a competent representative to be present when installation is put into operation to instruct the Owner and employees in the proper use and maintenance of all items in this Contract and to set up a maintenance schedule to be followed thereafter.
- B. Operation and Maintenance Manuals: FSEC shall organize operating and maintenance data into sets of manageable size. Bind data into individual binders properly identified and indexed. Bind each set of data in a heavy-duty 3-ring vinyl-covered binder, with pocket folders for folded sheet information. Submit three sets prior to final inspection. Provide data on all Mechanical and Electrical equipment and controls.
- C. Include the following types of information in Operation and Maintenance manuals, as a minimum: Operation and maintenance instructions, arranged by system. For each system, give names, addresses, and telephone numbers of subcontractors and suppliers. List:
1. Appropriate design criteria.
 2. List of equipment.
 3. Parts list.
 4. Operating instruction.
 5. Maintenance instructions, equipment.
 6. Maintenance instructions, finishes.
 7. Shop drawings and product data.
 8. Inspection procedures.
 9. Copies of warranties.
 10. Name, address and telephone number of manufacturer and qualified local representative providing warranty services.

Final payment on the contract will not be authorized until all required submittals are made and approved.

END OF SECTION 11 40 00

SECTION 11 40 11 - CUSTOM FABRICATED FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies custom-fabricated food service equipment as follows:
 - 1. Tables.
 - 2. Prep and scullery sinks.
 - 3. Pot washer, prep, and scullery sinks.
 - 4. Floor Trough

1.2 RELATED WORK

- A. Section 11 48 00, CLEANING AND DISPOSAL EQUIPMENT: Ware washing Equipment.
- B. Section 22 42 26, COMMERCIAL DISPOSERS: Waste Disposers.
- C. Section 23 38 13, COMMERCIAL KITCHEN HOODS

1.3 QUALITY CONTROL

- A. Manufacturer Qualifications: Approved by NSF International (NSF) for manufacturing items indicated.
- B. Installer Qualifications: Experienced in food service equipment installation or supervised by an experienced food service equipment installer.
 - 1. Where required to complete equipment installation, electrician and plumber shall be licensed in jurisdiction where project is located.
- C. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with NSF/ANSI 2.
- D. Electrical Components: Listed by UL and marked for intended use.
- E. Plumbing Fixture Fittings: Comply with ASME A112.18.1.
- F. Seismic Restraint:
 - 1. Comply with applicable guidelines for seismic restraint of kitchen equipment contained in SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Guidelines," Appendix A.
- G. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTALS
- B. Shop Drawings: Show dimensions, method of assembly, installation and conditions relating to adjoining work which requires cutting or close fitting, reinforcement, anchorage, and other work required for complete installation.

- C. Operating Instructions: In accordance with requirements in Section 01 33 00 SUBMITTALS and Section 00 72 13 GENERAL CONDITIONS.

1.5 WARRANTY

- A. Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction", FAR clause 52.246-21.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASME International (ASME):
 - A112.18.1-11.....Plumbing Fixture Fittings
- C. ASTM International (ASTM):
 - A554-16.....Welded Stainless Steel Mechanical Tubing
 - A666-15.....Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar
- D. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500-06Metal Finishes Manual
- E. NSF International/American National Standards Institute (NSF/ANSI):
 - 2-10Food Equipment
- F. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines, 20081

PART 2 - PRODUCTS

2.1 STAINLESS STEEL, GENERAL

- A. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304, stretcher leveled.
- B. Tube: ASTM A 554, Grade MT-304.
- C. Minimum Specified Thickness:
 - 1. Table and Counter Surfaces: 2.0 mm (0.0781 inch).
 - 2. Drain boards: 2.0 mm (0.0781 inch).
 - 3. Shelf Surfaces: 1.6 mm (0.0625 inch).
 - 4. Sink Bowls: 2.0 mm (0.0781 inch).
 - 5. Legs: 1.6 mm (0.0625 inch).
 - 6. Cross bracing: 1.6 mm (0.0625 inch).
- D. Finishes: Comply with NAAMM's AMP 500-505, Metal Finishes Manual. Grind and polish surfaces to produce uniform, directional textured, polished, free of cross scratches. Run grain with long dimension of each piece.
 - 1. Exposed Surfaces: No. 4 finish (bright, directional polish).
 - 2. Concealed Surfaces: No. 2B finish (bright, cold-rolled, unpolished finish).

2.2 COMPONENTS, GENERAL

- A. Sink Fittings:
 - 1. Faucets: Equip sinks with one faucet per sink bowl, unless otherwise indicated.
 - a. Splash mounted.
 - b. Lever handles.
 - c. Chrome-plated copper alloy.
 - 2. Drains: Equip sinks with 50 mm (2 inch) diameter, nickel-plated bronze, rotary-handle wastes and stainless-steel strainer plates with chrome-plated brass connected overflows.
- B. Spray Rinse Assemblies: As specified in Section 22 42 26, COMMERCIAL DISPOSERS.
- C. Splashes:
 - 1. Where backs of units abut walls, equip with splashbacks.
 - 2. Where units abut walls on sides, equip with side splashes.
- D. Legs: Fitted to top with 3 mm (1/8 inch) thick flange welded to underside of table/body.
 - 1. Feet: Adjustable, stainless steel, NSF certified.
 - 2. Spacing: Maximum 1825 mm (72 inches) o.c.
- E. Under counter Shelves: Stainless-steel sheet 25 mm (1 inch) diameter, stainless-steel tubing, running left to right, at 100 mm (4 inches) o.c. front to back.
- F. Sink Covers: To fit within sink opening; perforated with 10 mm (3/8 inch) holes at 50 mm (2 inches) o.c.; and with turned down edges and two recessed handles.
- G. Baskets: Stainless-steel wire baskets, 406 by 406 by 356 mm (16 by 16 by 14 inches); 32 mm (1-1/4 inch) square mesh, of 3 mm (0.12 inch) wire. Handles and frame supports are of 8 mm (5/16 inch) diameter rod. Handles welded to top and bottom frame members and extended 150 mm (6 inches) above top of basket. Equip handle with 125 mm (5 inch) wide, coil wire grip.
- H. Waste Disposers: As specified in Section 22 42 26, COMMERCIAL DISPOSERS.
- I. Pot Washers: As specified in Section 11 48 00, CLEANING AND DISPOSAL EQUIPMENT.

2.3 TABLES

- A. Item 53: Tables with Sinks: John Boos ST4R5-3072SBK+CUT1620124
 - 1. Accessories to Table 53
 - a. Disposer with controls: In-Sink-Erator SS-300+AS101, Quantity: 1 (Item 54)
 - 1) Required Utilities: 3-1/2" drain fitting
 - 2) Equivalent Manufacturers: Salvajor
 - b. Faucet, swing spout, deck-mounted: T&S B-0231 (Item 78)
 - 1) Required Utilities: 1/2" HW and CW
 - 2) Equivalent Manufacturers: Fisher, Chicago Faucet

ITEM #	SYMBOL	DESCRIPTION	COMPONENTS
53		Table with sinks,	New faucet, disposer with controls, right drainboard, left end splash, open base

B. Ware washing Tables:

2. Ware washing Table Requirements:

ITEM #	SYMBOL	DESCRIPTION	COMPONENTS
25		Table, soiled, for use with dishwasher	Sink Spray rinse assembly Right end splash Disposer with controls
32		Table, clean, for use with dishwasher	Left end splash

C. Tables, Work

ITEM #	SYMBOL	DESCRIPTION	COMPONENTS
59 (Qty 2)		Table, Work	Drawers, casters with brakes, undershelf, marine edge
60 (Qty 1)		Table, Work	Pot Rack, Drawers, casters with brakes, marine edge
75 (Qty 1)		Table, work	Drawers, casters with brakes, undershelf, marine edge
76 (Qty 1)		Table, work	Drawers, casters with brakes, undershelf, marine edge

D. Required Utilities:

E. Equivalent Manufacturers: Eagle,

2.4 SINKS

A. Pot-Washer, Prep, and Scullery Sinks:

a. Item 33: Three-compartment, scullery: John Boos 43PB244-2D30

i. Accessories

1. Vacuum breaker, Item 80: T&S B-0455
 - a. Required Utilities: 1/2" HW and CW
 - b. Equivalent Manufacturers: Fisher, Chicago Faucet
2. Swing spout faucet, Item 78: T&S B-0231-02
 - a. Required Utilities: 1/2" HW and CW
 - b. Equivalent Manufacturers: Fisher, Chicago Faucet
3. Pre-Rinse faucet, Item 35: T&S B-0133-12ACRB8S+B
 - a. Required Utilities: 1/2" HW and CW

- b. Equivalent Manufacturers: Fisher, Chicago Faucet
- 4. Waste valve lever, Item 79: T&S B-3950 (Qty 2)
 - a. Required Utilities: 3-1/2" drain fitting
 - b. Equivalent Manufacturers: Fisher, Chicago Faucet
- 5. Disposer with controls: Item 34: In-Sink-Erator SS-500+AS101
 - a. Required Utilities: 3-1/2" drain fitting
 - b. Equivalent Manufacturers: Salvajor

ITEM #	SYMBOL	COMPARTMENTS	COMPONENTS
33		Three	Sink New faucet Spray rinse assembly Left end Splash Disposer with controls Open base

B. Required Utilities:

C. Equivalent Manufacturers:

2.5 TROUGH, FLOOR

A. Floor trough: Item 52: IMC Teddy ASFT-2424-SG (Qty: 1)

B. Floor Trough: Item 77: IMC Teddy ASFT-3030-SG (Qty: 1)

ITEM #	SYMBOL		
52			
77			

C. Required Utilities: 4" Drain

D. Equivalent Manufacturers: Eagle

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install custom-fabricated equipment level and plumb; arranged for safe and convenient operation; with access clearances required for maintenance and cleaning.
- B. Interconnect equipment to service utilities.

3.2 CLEAN-UP

- A. At completion of the installation, clean and adjust custom-fabricated equipment as required to produce ready-for-use condition.
- B. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS

- A. Instruct personnel and transmit operating instructions in accordance with requirements in Section 01 00 00, GENERAL REQUIREMENTS.

END OF SECTION 11 40 11

SECTION 11 41 00 - FOOD STORAGE EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies self-contained refrigeration equipment as follows:
 - 1. Existing Automatic ice making and dispensing stations.
 - 2. Automatic ice making and ice and water dispensing stations.
 - 3. Refrigerators and Freezers, reach-in.

1.2 RELATED WORK

- A. Section 22 11 13, FACILITY WATER DISTRIBUTION PIPING: Plumbing Connections.
- B. Section 26 05 19, CONDUCTORS: Electrical Connections.

1.3 QUALITY CONTROL

- A. Installer Qualifications: Factory-trained refrigeration technicians and experienced with food service refrigeration equipment installation or supervised by an experienced food service equipment installer.
- B. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark:
 - 1. Refrigerators and Freezers: Evaluated according to NSF/ANSI 7.
 - 2. Ice Makers: Evaluated according to NSF/ANSI 12.
- C. UL Listing: Equipment is listed and labeled by UL:
 - 1. Refrigerators and Freezers: Evaluated according to UL 471.
 - 2. Ice Makers: Evaluated according to UL 563.
- D. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTALS
- B. Shop Drawings: Show dimensions, method of assembly, installation and conditions relating to adjoining work which requires cutting or close fitting, reinforcement, anchorage, and other work required for complete installation.
- C. Operating Instructions: In accordance with requirements in Section 01 33 00 SUBMITTALS and Section 00 72 13 GENERAL CONDITIONS.

1.5 WARRANTY

- A. Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction", FAR clause 52.246-21, except warranty period for refrigeration compressors shall be five years.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. NSF International/American National Standards Institute (NSF/ANSI):
 - 7-09 Commercial Refrigerators and Freezers
 - 12-09 Automatic Ice Making Equipment
- C. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): Publication 1767 Kitchen Ventilation Systems & Food Service Equipment Fabrication and Installation Guidelines, 2001.
- D. Underwriters Laboratories Inc. (UL):
 - 471-10 Commercial Refrigerators and Freezers, 8th Edition: Revised 2004
 - 563-09 Ice Makers, 7th Edition: Revised 2006

PART 2 - PRODUCTS

2.1 EXISTING AUTOMATIC ICE MAKING AND DISPENSING STATIONS

- A. General Requirements: Automatic ice makers and dispensers as follows:
 - 1. Stainless-steel exterior, front and sides.
 - 2. Air-cooled compressor.
 - 3. Insulated storage bin with agitator.
 - 4. Cube-type ice.
 - 5. Dispensing area located between 813 and 1016 mm (32 and 40 inches) above the floor.
 - 6. Ice dispenser.
 - 7. Accessories:
 - a. Stainless-steel stand with 152 mm (6 inch) stainless-steel legs.
 - b. Water filter with 0.1 liter/second (1.67 gallons per minute) maximum flow rate.
 - 8. Provide Energy Star qualified appliances.
- B. Existing Automatic Ice Making and Dispensing Units:

SYMBOL	CAPACITY	
	295-kg (650-lb) ice production 227-kg (500-lb) bin storage	

2.2 AUTOMATIC ICE MAKING AND ICE AND WATER DISPENSING STATIONS

- A. General Requirements: Automatic ice makers and dispensers as follows:
 - 1. Stainless-steel exterior, front and sides.
 - 2. Air-cooled compressor.
 - 3. Insulated storage bin with agitator.
 - 4. Cube-type ice.
 - 5. Dispensing area located between 813 and 1016 mm (32 and 40 inches) above the floor.
 - 6. Ice dispenser.
 - 7. Water dispenser.
 - 8. Accessories:
 - a. Stainless-steel stand with 152 mm (6 inch) stainless-steel legs.
 - b. Water filter with 0.1- liter/second (1.67 gallons per minute) maximum flow rate.
 - 9. Provide Energy Star qualified appliances.
- B. Automatic Ice Making and Ice and Water Dispensing Units:

SYMBOL	CAPACITY	
	227-kg (500-lb) ice production	
	11.3-kg (25-lb) bin storage	

2.3 REFRIGERATORS, FREEZERS, REACH-IN

- A. General Requirements:
 - 1. Exterior Finish: Stainless steel, door, sides, and top.
 - 2. Interior Finish: Stainless steel.
 - 3. Doors: Full height with door locks.
 - 4. Door Hinge: As shown on drawings.
 - 5. Refrigeration System: Self-contained, air cooled, top mounted.
 - 6. Accessories:
 - a. 127 mm (5 inch) high casters.
 - b. Cord and plug.
 - c. Stainless-steel back.
 - 7. Provide Energy Star qualified appliances.
- B. Shelves: Six chrome-plated wire shelves per full section.
- C. Tray Slides: Universal Angle type.
- D. Temperature:
 - 1. Normal: 1.6 degrees C (35 degrees F).
 - 2. Low: -23.3 degrees C (-10 degrees F).
- E. Reach-in Refrigerator, Freezer:

SYMBOL	TEMPERATURE	STYLE	SIZE	FOOD STORAGE
	Low	Reach-in	1.4 cubic meter (48 cubic feet) Two sections	Shelves
	Low	Reach-in	1.98 cubic meter (70 cubic feet) Three sections	Shelves
	Normal	Reach-in	1.4 cubic meter (48 cubic feet) Two sections	Shelves

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install self-contained refrigeration equipment level and plumb; arranged for safe and convenient operation; with access clearances required for maintenance and cleaning; and according to manufacturer's written instructions.
- B. Install seismic restraints for equipment.

3.2 CLEAN-UP

- A. At completion of the installation, clean and adjust self-contained refrigeration equipment as required to produce ready-for-use condition.
- B. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS

- A. Instruct personnel and transmit operating instructions in accordance with requirements in.

END OF SECTION 11 41 00

SECTION 11 41 21 - WALK-IN COOLERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies walk-in site assembled refrigerators.

1.2 RELATED WORK

- A. Section 11 05 12, GENERAL MOTOR REQUIREMENTS FOR EQUIPMENT.
- B. Section 23 23 00, REFRIGERANT PIPING AND SPECIALTIES: Piping, pipe insulation and refrigerant.
- C. Refer to the construction documents for the refrigeration equipment schedules and installation details.
- D. Refer to Division 26, ELECTRICAL for lighting and power requirements.

1.3 WARRANTY

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".
- B. Refrigeration Compressor Warranty: Manufacturer agrees to repair or replace compressors that fail in materials or workmanship within five (5) years from the date of final acceptance by the Government. Failure includes but is not limited to inability to maintain set temperature. Submit compressor warranty. Walk-in Panels to be warranted for ten (10) years.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTALS
- B. Shop Drawings: Show dimensions, method of assembly, installation and conditions relating to adjoining work which requires cutting or close fitting, reinforcement, anchorage, and other work required for complete installation.
- C. Operating Instructions: In accordance with requirements in Section 01 33 00 SUBMITTALS and Section 00 72 13 GENERAL CONDITIONS.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air-Conditioning and Refrigeration Institute (ARI):
 - 420-08 Unit Coolers for Refrigeration.
 - 520-04 Performance Rating of Positive Displacement Condensing Units.
- C. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - 15-10-16 Safety Standard for Refrigeration Systems
- D. ASTM International (ASTM):
 - A240/A240M-20 Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and For General Applications

- E84-20..... Surface Burning Characteristics of Building Materials
- E. National Sanitation Foundation/American National Standard (NSF/ANSI):
 - 7-09 Commercial Refrigerators and Storage Freezers
- F. National Fire Protection Association (NFPA):
 - 70-20 National Electric Code
- G. Underwriters Laboratories, Inc. (UL):
 - 207-08(R2014) Refrigerant-Containing Components and Accessories,
Nonelectrical
 - 471-10(R2014) Commercial Refrigerators and Freezers
 - 1598-03(R2012) Luminaires

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NSF Standards: Provide equipment that bears NSF Certification Mark certifying compliance with applicable standards.
- B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.
- C. Regulatory Requirements: Install equipment to comply with the following:
 - 1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
 - 2. NFPA 70, "National Electric Code."

2.2 WALK-IN REFRIGERATOR CONSTRUCTION

- A. General: Prefabricated, sectional, all-metal clad, modular, designed for easy accurate field assembly.
- B. Provide walk-in units manufactured for food service use conforming to NSF/ANSI 7, UL 207, and UL 471. // Floorless, with floor screeds, installed over sealed concrete floor.
- C. Panel Construction:
 - 1. General: Interchangeable, 1219 mm (48 inch) maximum width, 101 mm (4 inch) thick, filled with insulation. Double seal serrated neoprene rubber gaskets to assure air and vapor tight joints.
 - 2. Corner panels: 90 degree angle, radiuses 15 mm (0.5 inch) inside and outside, with 305 mm (12-inch) dimensions each side.
 - 3. Panel edges: Foam-in-place, tongue-and-grooved urethane to assure tight joints. Provide double seal serrated neoprene rubber gaskets to assure air and vapor tight joints on the interior and exterior of each panel along every tongue.
 - 4. Insulation: 101 mm (4 inch) minimum foamed-in-place polyurethane with manufacturer's rated "K" factor of not more than 0.15, free rise design of not less than 27 kg per cubic meter

(1.7 pounds per cubic foot), or in-place density of not less than 32 kg per cubic meter (2 pounds per cubic foot). Provide floor screeds with minimum of 63 mm (2-1/2 inches) of foamed insulation.

5. Door Panel and Door:
 - a. Provide channel thermal breaker type reinforcing steel frame around the entire perimeter of the door opening.
 - b. Door to be an infitting flush-mounted type with dual flexible blade wiper gasket on the bottom, and a replaceable magnetic gasket on the top edge and along both sides.
 - c. Provide heated, double glass view windows in refrigerator doors.
 - d. Door to be equipped with a minimum of three (3) hinges, for rough usage including aluminum diamond plate on inside of door panel and frame to a height of 915 mm (36 inches).
 - e. Provide hydraulic exterior door closer to prevent slamming and assure secure closing.
 - f. Door hinges and latch and strike assembly: Manufacturer's standard, self-closing cam-lift type hinges, for 1219 mm (48 inch) door, chrome plated or polished aluminum finish, made to provide for locking, but with an inside safety release mechanism to prevent anyone from being locked inside when door is locked from outside.
 - g. Concealed, energy use selective, anti-sweat heater wire circuit: Provide sufficient heat to prevent condensation and frost formation at the door jambs and exterior edges of the door on all sides.
 - h. Thermometer: Manufacturer's standard, 50 mm (2-inch) minimum diameter, dial type, flush mounted in door panel.
6. // Floorless Refrigeration Floors:
 - a. Make floorless refrigerator floors flush with the surrounding building floor.

- D. Wherever compartment dimension exceed clear-span ability of ceiling panels, provide I-beam support on exterior of ceiling or spline-hangers. Install 13 mm (1/2 inch) diameter steel rods through beam/hangers and secure to structure above. Beams or posts within compartments are not acceptable.
- E. Rub rail wall protectors: Manufacturer's standard, at floor line of walls exposed to traffic.
- F. Lights: Provide high-efficiency rated LED light fixtures with safety shields. Lighting must conform with UL IP-65. Provide with diffuser and be capable of operating in minus 23 degrees C (-40 degrees Fahrenheit) temperature. Lights must run length of walk-in starting 610 mm (24 inches) from front panel and extending within 610 mm (24 inches) of back panel. Run between shelf rows to obtain 323 lux (30 foot-candles) at floor level regardless of any interior furnishings.

2.3 CONDENSING UNITS

- A. Comply with ARI Standard 520. Air cooled, type as shown in construction documents.
- B. Provide motor driven integral compressor, motor starter, condenser, receiver, common base, and safety/operational controls.

- C. Receiver capacity not to be less than 125 percent of system refrigerant charge.
- D. For units racked above each other and for units installed in a closet, provide a factory fabricated steel rack extending approximately 1143 mm (45 inches) above the floor.
- E. Do not locate compressors on top of refrigerators.
- F. Provide positive oil lubrication and oil level indicating device for each compressor.
- G. Compressor Motor: Squirrel cage induction type of ample size for continuous operating at maximum compressor performance. Provide inherent protection, in compressor terminal box, for each phase of motor.
- H. Pressure Switches: Automatic reset low pressure switch, and automatic or manual reset high pressure cutout.
- I. Air Cooled Condensing Units:
 - 1. High efficiency type piped and automatically controlled to operate at lower head pressures during low ambient temperature conditions. Designed and weather-proofed for outdoor installation, to operate satisfactorily at winter ambient temperatures down to // 6 degrees C (10 degrees F) and be provided with crankcase and receiver heaters.
 - 2. The condenser fans are to be driven by permanent split capacitor motors.

2.4 UNIT COOLERS

- A. Comply with ARI Standard 420. Units to be UL listed, forced-ventilation type. Provide demand defrost controllers for defrosting, internal or external refrigerant distributor, single or multiple fans and motors, drip-pan, deflectors, aluminum or baked-enamel steel housing, hangers, and all accessories. Unit coolers for kitchen walk-in units to be NSF approved.
- B. Motors: Permanent split capacitor type in accordance with Section 11 05 12, GENERAL MOTOR REQUIREMENTS FOR EQUIPMENT. Provide motors with thermal overload protection and manual starting switch.
- C. Drain Pans: Galvanized sheet steel. Provide additional drain pans under uncovered refrigerant connections and interconnect them with main drain pan.
- D. Defrost Provision:
 - 1. Refrigerators: Defrost to be as needed with Demand defrost controllers and occur during compressor off cycle with evaporator fan running continuously.

2.5 MONITORING ALARM SYSTEM

- A. Provide an electronic monitoring and alarm system for each section of each unit.
 - 1. System Components: Detecting thermostat, master control panel, interconnecting wiring, remote audible alarm, and defrost compensator. Provide dials showing temperatures and pilot lights, warning lights, switches, transformer, and buzzer, all as a part of the master control panel. Locate master control panel and remote audible alarm as indicated on construction documents. Provide power fuse to protect system components.

2. System Operation: Set alarms at 5 degrees C (10 degrees F) above and below specified operating temperatures.
- B. Personnel Alarm: For each unit, provide separate audible alarm system operable from inside unit, for use of personnel unable to exit unit. Locate remote audible alarm where indicated on construction documents.

2.6 EQUIPMENT IDENTIFICATION REQUIREMENTS

- A. Refer to Section 23 05 00, BASIC HVAC REQUIREMENTS.
- B. Identify all walk-ins, refrigeration equipment and alarm devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble walk-in units and install refrigeration equipment as described in the respective manufacturer's instructions. Make panel joints tight and seal all panel penetrations to prevent condensation or frosting.
 1. Unit cooler: NSF approval requires that the unit be suspended at 90 mm (3-1/2 inches) minimum distance below the ceiling to allow cleaning the top of the unit cooler.
 2. Mount pipe, conduit, and instrumentation on the exterior and pass thru neatly drilled penetrations to the lights or other devices.
- B. Piping, Pipe Insulation and Refrigerant: Provide in accordance with Section 23 23 00, REFRIGERANT PIPING AND SPECIALTIES.

3.2 REFRIGERATOR START-UP, AND PERFORMANCE TESTS AND INSTRUCTIONS

- A. Initial Start-up and Operational Test:
 1. Provide all lubricants and accessories before initial start-up. Start and operate all equipment.
 2. Follow the manufacturer's procedures and place the systems under all modes of operation.
 3. Supplement initial charges of lubricating oil to assure maximum operating capacity.
 4. Adjust all safety and automatic control instruments. Record manufacturer's recommended readings hourly.
 5. Operational tests must cover a period of not less than three (3) days. Submit operational test report.
- B. Test Reports: Submit the final field test reports for each system tested, describing test apparatus, instrumentation calculations, and equipment data based on industry standard forms. Include in data:
 1. Compressor and air moving device ampere readings.
 2. Power supply characteristics, including phase imbalance, with 1/2 percent accuracy.
 3. Thermostatic expansion valve superheat-value as determined by field test.
 4. Sub-cooling.
 5. High and low refrigerant temperature switch set-points.

6. Monitoring alarm system.
 7. Low oil pressure switch set-point.
 8. Defrost system timer and thermostat set-points.
 9. Moisture content.
 10. Ambient, condensing and coolant temperatures.
 11. Capacity control set-points.
 12. Field data and adjustments which affect unit performance and energy consumption.
 13. Where final adjustments and settings cannot be permanently marked or drilled and pinned as an integral part of device, include adjustment and setting data in test report.
- C. By arrangement with the Contracting Officer Representative (COR), 24 hours in advance, use the start-up and test period for required operation and maintenance instructions to VA personnel in accordance with Section 00 72 13, GENERAL CONDITIONS.

END OF SECTION 11 41 21

SECTION 11 41 33 - FOODSERVICE SHELVING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies food service shelving as follows:
 - 1. Shelving, wire.
 - 2. Shelving, utility.
 - 3. Shelving, walk-in.

1.2 QUALITY CONTROL

- A. Manufacturer Qualifications: Approved by NSF International (NSF) for manufacturing items indicated.
- B. Installer Qualifications: Experienced in food service equipment installation or supervised by an experienced food service equipment installer.
- C. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with NSF/ANSI 2.
- D. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTALS
- B. Shop Drawings: Show dimensions, method of assembly, installation and conditions relating to adjoining work which requires cutting or close fitting, reinforcement, anchorage, and other work required for complete installation.
- C. Operating Instructions: In accordance with requirements in Section 01 33 00 SUBMITTALS and Section 00 72 13 GENERAL CONDITIONS.

1.4 WARRANTY

- A. Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction", FAR clause 52.246-21.
- B. Warranty – InterMetro Products – MetroMax i High Density Storage Systems:
 - 1. Shelves and Posts – limited lifetime warranty.
 - 2. Track, casters, and misc. components – 1 materials and workmanship.
- C. Warranty – InterMetro Products – MetroMax 4 Storage System:
 - 1. One year parts and labor.
 - 2. Limited Lifetime Warranty against rust and corrosion.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASME International (ASME):
- C. ASTM International (ASTM):
- D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06 Metal Finishes Manual
- E. NSF International/American National Standards Institute (NSF/ANSI):
2-10 Food Equipment

PART 2 - PRODUCTS

2.1 SHELVING, WIRE

- A. Where indicated on the drawings, provide shelving units as manufactured by:
 - 1. InterMetro Industries Corporation
651 North Washington Street
Wilkes-Barre, PA 18705
- B. The shelving system shall consist of solid and/or open grid shelf mats which are supported by side beams, end beams, and vertical posts of polymer material. The shelving system shall carry the listing mark of NSF International (NSF), Ann Arbor, MI.
- C. Shelving Units shall be constructed of:
 - 1. Side Beams and Posts: Pultrusions – Glass- reinforced polyester thermoset resin with Microban® antimicrobial additive.
 - 2. End Beams, Side Beam Inner Connector Clip, Side Beam Center Clip, Adjustable Foot Post Stem Receptacle, & Shelf Wedge Connector: Injection molded glass-reinforced nylon-6.
 - 3. Post Cap: Injection molded high-density polyethylene.
 - 4. Shelf Mats, Open Grid & Solid: Injection molded glass-reinforced polypropylene co-polymer impregnated with Microban® anti-microbial additive.
 - 5. Shelf “S-Hooks”: Electropolished type-304 stainless steel.
 - 6. Heavy Duty Dunnage Shelf: (Reference MetroMax i™ Specification 10671 Sections 2.2 § L.)
 - 7. Load ratings: Shall be 600 lbs. (272kg.) evenly distributed load per shelf up to a maximum of 2,000 lbs. (907 kg.) per stationary unit, or 750 lbs. (340 kg.) per mobile unit with appropriate stem casters.
 - 8. Interchangeable open grid and solid shelf mats shall be removable (lift-off) for commercial washer cleaning. Solid shelf mats shall have built-in recesses to enable containment of minor spills.
 - 9. MetroMax 4™ shelving systems shall have the capability of being made mobile by: selecting a post without a leveling foot (stem caster mobile post) and adding any standard Metro stem caster designed to fit MetroMax 4™ shelving systems.

10. Accessories – (Specifier shall include pertinent information concerning various accessories for the project/contract.)

D. Shelf Unit, General Data:

1. The assembly system shall enable the installer to complete the erection of a complete shelving system in a timely manner, without tools.
2. Posts shall have numbered grooves at 1" (25mm) intervals.
3. Fully assembled shelving units shall have open grid and/or solid shelf mats that can be removed and/or interchanged at any time.

E. Fabrication:

1. Shop assembly shall be done in a facility that conforms to requirements of ISO9001.
2. All units shall be built to order in accordance with standard product documentation in accordance with ISO 9001.

F. Source Quality Control:

1. Tests (Type)
 - a. Static load and stability tests on stationary shelving per Metro test specifications.
 - b. Threshold tests with mobile shelving while holding rated mobile unit capacity per Metro test specifications.

G. Packaging and Shipping:

1. Shelves shall be packed either 2 or 4 to a carton with a copy of the work order. Posts shall be packed 4 to a carton.

H. Assembly/Installation:

1. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section. (For wall hung units only.)
2. Install the work of this section in strict accordance with the original design, the approved shop drawings, and the manufacturer's recommended installation procedures as approved by the Professional, anchoring all components into position according to manufacturers' written instructions, using fasteners appropriate to substrate indicated. Install units level, plumb, and firmly anchored in locations and at heights indicated. (For all hung units only).
3. Posts have numbered grooves at 1" (25mm) increments, shelf wedge lock connectors, with window and pointer to locate desired post groove, and snap onto posts. Attach the shelf wedge lock connectors at the desired post height and lower the shelf into place.

I. Cleaning and Protection:

1. Final cleaning shall be with mild detergent and water (not scouring powder).
2. Contractor shall adhere to manufacturers' recommendations for protection of products supplied under this section, from delivery to acceptance by owner.
3. Solid and open-grid shelf mats must be able to lift off the shelf frame for cleaning away from the site. Solid and open-grid shelf mats, in 6" (152mm) lengths, must be able to be removed individually so cleaning can be done as time permits. Shelf mats fit easily into the commercial wash machine.

J. Maintenance and Reconfiguration:

1. Supplier shall provide to the owner instructions required to maintain and reconfigure products supplied under this section.
2. Supplier shall also make warranty information available on its website:
www.metro.com/support.

ITEM #	SYMBOL	DESCRIPTION	COMPONENTS
71 (Qty 4)		Wire Shelving	

K. Required Utilities: None

L. Equivalent Manufacturers: Eagle

2.2 SHELVING, WALK-IN

A. Shelving, walk-in: Metro Max Q Polymer Shelving

ITEM #	SYMBOL	DESCRIPTION	COMPONENTS
72 (Qty 3)		Wire storage shelving	
73 (Qty 1)		Wire storage shelving	
74 (Qty 2)		Wire storage shelving	
81 (Qty 2)		Wire storage shelving	

B. Required Utilities: None

C. Equivalent Manufacturers: Eagle

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install custom-fabricated equipment level and plumb; arranged for safe and convenient operation; with access clearances required for maintenance and cleaning.
- B. Interconnect equipment to service utilities.

3.2 CLEAN-UP

- A. At completion of the installation, clean and adjust custom-fabricated equipment as required to produce ready-for-use condition.
- B. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS

- A. Instruct personnel and transmit operating instructions in accordance with requirements in Section 00 72 13, GENERAL CONDITIONS.

END OF SECTION 11 41 33

SECTION 11 42 13 - FOOD PREPARATION APPLIANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies food preparation appliances as follows:
 - 1. Can opener, manual.
 - 2. Mixer.
 - 3. Slicer.
 - 4. Ingredient bins, mobile.

1.2 RELATED WORK

- A. Section 26 05 00, ELECTRICAL GENERAL PROVISIONS

1.3 QUALITY CONTROL

- A. Installer Qualifications: Experienced in food service equipment installation or supervised by an experienced food service equipment installer:
 - 1. Where required to complete equipment installation, electrician and plumber shall be licensed in jurisdiction where project is located.
- B. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with NSF/ANSI 4E.
- C. UL Listing: Equipment is listed in UL and is labeled for intended use.
- D. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTALS
- B. Shop Drawings: Show dimensions, method of assembly, installation and conditions relating to adjoining work which requires cutting or close fitting, reinforcement, anchorage, and other work required for complete installation.
- C. Operating Instructions: In accordance with requirements in Section 01 33 00 SUBMITTALS and Section 00 72 13 GENERAL CONDITIONS.

1.5 WARRANTY

- A. Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction", FAR clause 52.246-21.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute/Canadian Gas Assoc. (ANSI/CGA):
Z83.11-09..... Gas Food Service Equipment
- C. ASME International (ASME):
BPVC-11 Boiler and Pressure Vessel Code
- D. NSF International/American National Standards Institute (NSF/ANSI):
4E-09..... Commercial Cooking, Rethermalization, and Powered Hot Food Holding and Trans Equipment
- E. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): Publication 1767
Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines, 2001
- F. Underwriters Laboratories Inc. (UL):
197-10 Commercial Electric Cooking Appliances UL Heating, Cooling, Ventilating and Cooking Equipment Directory

PART 2 - PRODUCTS

2.1 CAN OPENER, MANUAL

1. General Description: Edlund S-11 can opener.

ITEM #	VERIFIED UTILITIES
65	None

2.2 MIXER, COUNTERTOP

1. General Description: Hobart HL200-2STD countertop mixer.

ITEM #	VERIFIED UTILITIES
64	240/60/1, 5 amps, 1/2 hp, 6-15P

2.3 MIXER, PLANETARY

1. General Description: Hobart HL400-2STD countertop mixer.

ITEM #	VERIFIED UTILITIES
63	240/60/1, 5 amps, 1/2 hp, 6-15P

2.4 SLICER

- A. General Description: Hobart HS7N-1

ITEM #	VERIFIED UTILITIES
66	120/60/1, 5.6 amps, 1/2 hp, 5-15P

2.5 INGREDIENT BINS (QTY 3)

1. General Description: Cambro IBS27148 ingredient bins.

ITEM #	VERIFIED UTILITIES
10	None

PART 3 - EXECUTION

3.1 INSTALLATION

1. Install food preparation appliances level and plumb; arranged for safe and convenient operation; with access clearances required for maintenance and cleaning; and according to manufacturer's written instructions.
2. Interconnect food preparation appliances to service utilities.

3.2 CLEAN-UP

1. At completion of the installation, clean and adjust food preparation appliances as required to produce ready-for-use condition.
2. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS

1. Instruct personnel and transmit operating instructions in accordance with requirements in Section 00 72 13, GENERAL CONDITIONS.

END OF SECTION 11 42 13

SECTION 11 42 15 - TRAY LINE AND SERVING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies tray line and serving equipment as follows:
 - 1. Cart, food delivery.
 - 2. Table, refrigerated.
 - 3. Steam table.

1.2 RELATED WORK

- A. Section 26 05 00, ELECTRICAL GENERAL PROVISIONS

1.3 QUALITY CONTROL

- A. Installer Qualifications: Experienced in food service equipment installation or supervised by an experienced food service equipment installer:
 - 1. Where required to complete equipment installation, electrician and plumber shall be licensed in jurisdiction where project is located.
- B. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with NSF/ANSI 4E.
- C. UL Listing: Equipment is listed in UL and is labeled for intended use.
- D. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTALS
- B. Shop Drawings: Show dimensions, method of assembly, installation and conditions relating to adjoining work which requires cutting or close fitting, reinforcement, anchorage, and other work required for complete installation.
- C. Operating Instructions: In accordance with requirements in Section 01 33 00 SUBMITTALS and Section 00 72 13 GENERAL CONDITIONS.

1.5 WARRANTY

- A. Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction", FAR clause 52.246-21.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

- B. NSF International/American National Standards Institute (NSF/ANSI):
 4E-09.....Commercial Cooking, Rethermalization, and Powered Hot Food
 Holding and Trans Equipment
- C. Underwriters Laboratories Inc. (UL):

PART 2 - PRODUCTS

2.1 CART, FOOD DELIVERY

1. General Description: FWE TS-1826 food delivery cart.

ITEM #	VERIFIED UTILITIES
19	120/60/1, 11 amps, 13.15 kw, 5-15P

2.2 TABLE, REFRIGERATED

1. General Description: LTI 66-CFMA refrigerated table.

ITEM #	VERIFIED UTILITIES
16	120/60/1, 7.1 amps, 1/3 hp, 5-15P

2.3 STEAM TABLE

1. General Description: 5-well steam table EXISTING TO BE RE-USED.

ITEM #	VERIFIED UTILITIES
17	120/60/1, 25.0 amps, 5-30P

PART 3 - EXECUTION

3.1 INSTALLATION

1. Install food preparation appliances level and plumb; arranged for safe and convenient operation; with access clearances required for maintenance and cleaning; and according to manufacturer's written instructions.
2. Interconnect food preparation appliances to service utilities.

3.2 CLEAN-UP

1. At completion of the installation, clean and adjust food preparation appliances as required to produce ready-for-use condition.
2. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS

1. Instruct personnel and transmit operating instructions in accordance with requirements in Section 00 72 13, GENERAL CONDITIONS.

END OF SECTION 11 42 15

SECTION 11 43 13 - FOOD AND WARE DELIVERY CARTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies food and ware delivery carts as follows:
 - 1. Dolly, dishrack.
 - 2. Tray and Flatware Dispenser
 - 3. Can Rack

1.2 QUALITY CONTROL

- A. Manufacturer Qualifications: Approved by NSF International (NSF) for manufacturing items indicated.
- B. Installer Qualifications: Experienced in food service equipment installation or supervised by an experienced food service equipment installer.
- C. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with NSF/ANSI 2.
- D. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTALS
- B. Shop Drawings: Show dimensions, method of assembly, installation and conditions relating to adjoining work which requires cutting or close fitting, reinforcement, anchorage, and other work required for complete installation.
- C. Operating Instructions: In accordance with requirements in Section 01 33 00 SUBMITTALS and Section 00 72 13 GENERAL CONDITIONS.

1.4 WARRANTY

- A. Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction", FAR clause 52.246-21.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
 - A554-16.....Welded Stainless Steel Mechanical Tubing
 - A666-15.....Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

- C. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06Metal Finishes Manual
- D. NSF International/American National Standards Institute (NSF/ANSI):
2-10Food Equipment

PART 2 - PRODUCTS

2.1 STAINLESS STEEL, GENERAL

- A. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304, stretcher leveled.
- B. Tube: ASTM A 554, Grade MT-304.
- C. Minimum Specified Thickness:
 - 1. Table and Counter Surfaces: 2.0 mm (0.0781 inch).
 - 2. Shelf Surfaces: 1.6 mm (0.0625 inch).
 - 3. Legs: 1.6 mm (0.0625 inch).
 - 4. Cross bracing: 1.6 mm (0.0625 inch).
- D. Finishes: Comply with NAAMM's AMP 500-505, Metal Finishes Manual. Grind and polish surfaces to produce uniform, directional textured, polished, free of cross scratches. Run grain with long dimension of each piece.
 - 1. Exposed Surfaces: No. 4 finish (bright, directional polish).
 - 2. Concealed Surfaces: No. 2B finish (bright, cold-rolled, unpolished finish).

2.2 COMPONENTS, GENERAL

- A. Legs: Fitted to top with 3 mm (1/8 inch) thick flange welded to underside of table/body.
 - 1. Feet: Adjustable, stainless steel, NSF certified.
 - 2. Spacing: Maximum 1825 mm (72 inches) o.c.

2.3 DOLLY, DISHRACK

- A. General Description: CresCor 5002020 dishrack dolly.

ITEM #	VERIFIED UTILITIES
2	None

2.4 TRAY AND FLATWARE DISPENSER

- A. General Description: Caddy CM-1814-2CS dispenser, quantity: 3

ITEM #	VERIFIED UTILITIES
1	None

2.5 RACK, CAN

- A. General Description:
 - 1. Item 11: PVIS CR162S pan rack, quantity: 3.

ITEM #	VERIFIED UTILITIES
11	None

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install custom-fabricated equipment level and plumb; arranged for safe and convenient operation; with access clearances required for maintenance and cleaning.
- B. Interconnect equipment to service utilities.

3.2 CLEAN-UP

- A. At completion of the installation, clean and adjust custom-fabricated equipment as required to produce ready-for-use condition.
- B. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS

- A. Instruct personnel and transmit operating instructions in accordance with requirements in Section 00 72 13, GENERAL CONDITIONS.

END OF SECTION 11 43 13

SECTION 11 44 00 - FOOD COOKING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies food service cooking equipment as follows:
 - 1. Ranges, gas.
 - 2. Pans, braising, tilting, electric.
 - 3. Kettles, tilting, gas
 - 4. Urns, coffee.
 - 5. Ovens, Combi, electric
 - 6. Ovens, Convection, electric

1.2 RELATED WORK

- A. Section 22 05 19, PLUMBING METERS AND GAUGES
- B. Section 22 11 13, FACILITY WATER DISTRIBUTION PIPING
- C. Section 22 13 13, FACILITY SANITARY SEWERS
- D. Section 26 05 00, ELECTRICAL GENERAL PROVISIONS

1.3 QUALITY CONTROL

- A. Installer Qualifications: Experienced in food service equipment installation or supervised by an experienced food service equipment installer:
 - 1. Where required to complete equipment installation, electrician and plumber shall be licensed in jurisdiction where project is located.
- B. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with NSF/ANSI 4E.
- C. UL Listing: Equipment is listed in UL "Heating, Cooling, Ventilating and Cooking Equipment Directory" and is labeled for intended use.
 - 1. Electric Cooking Equipment: Evaluated according to UL 197.
 - 2. Gas-Burning Cooking Equipment: Evaluated according to ANSI Z83.11/CGA 1.8-M96 and its addendum.
- D. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTALS

- B. Shop Drawings: Show dimensions, method of assembly, installation and conditions relating to adjoining work which requires cutting or close fitting, reinforcement, anchorage, and other work required for complete installation.
- C. Operating Instructions: In accordance with requirements in Section 01 33 00 SUBMITTALS and Section 00 72 13 GENERAL CONDITIONS.

1.5 WARRANTY

- A. Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction", FAR clause 52.246-21.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute/Canadian Gas Assoc. (ANSI/CGA):
Z83.11-09 Gas Food Service Equipment
- C. ASME International (ASME):
BPVC-11 Boiler and Pressure Vessel Code
- D. NSF International/American National Standards Institute (NSF/ANSI):
4E-09 Commercial Cooking, Rethermalization, and Powered Hot Food Holding and Trans Equipment
- E. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): Publication 1767 Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines, 2001
- F. Underwriters Laboratories Inc. (UL):
197-10 Commercial Electric Cooking Appliances UL Heating, Cooling, Ventilating and Cooking Equipment Directory

PART 2 - PRODUCTS

2.1 RANGES, GAS – EXISTING TO BE RE-USED

- A. General Requirements: Heavy-duty (designed for constant use in institutional-type kitchen) gas ranges as follows:
 - 1. Stainless-steel exterior finish.
 - 2. Electronic ignition.
 - 3. Flue riser not less than 406 mm (16 inch) high.
 - 4. Rear gas connection.
 - 5. Swivel casters with brakes on front casters.
 - 6. Gas flex hose and quick disconnect with restraining device.
 - 7. Accessories:
 - 1. Extra oven rack for each oven compartment.

B. Gas Range Units:

SYMBOL	TOP COMPONENT	BASE
	Eight burners	Standard ovens

2.2 PANS, BRAISING, TILTING, ELECTRIC – EXISTING TO RE-USED

A. General Requirements: Electric, tilting braising pans as follows:

1. Stainless-steel construction.
2. 178 mm (7 inch) deep pan.
3. Spring-assisted cover.
4. Manual tilt.
5. Gallon and liter markings.
6. Electric ignition.
7. Accessories:
 1. Item 43 - NEW stand for BRAISING PAN .

B. Electric, Tilting Braising Pan Units:

SYMBOL	CAPACITY
	45 liters (12 gallons)

2.3 KETTLES, STEAM, TILTING, GAS

A. General Requirements: Gas, tilting steam kettles as follows:

1. Stainless-steel kettle and supports, Type 304 with No. 4 finish.
2. // 51 mm (2 inch) long, tangent draw-off with strainer.
3. Spring-assisted cover.
4. Insulated steam jacket.
5. Tilt mechanism.
6. Electronic ignition.
7. Options and Accessories:
 1. Type 316 stainless-steel kettle liner for high-acid food products.
 2. Hot and cold-water faucet with swing spout.
 3. Kettle gallon and liter markings.
 4. Kettle brush kit.
 5. Basket inserts.

B. Gas, Tilting Steam Kettle Units:

SYMBOL	JACKETED KETTLE	CAPACITY
	Two-thirds	151 liters (40 gallons)

2.4 OVENS, CONVECTION – EXISTING TO BE RE-USED

A. General Requirements: Convection ovens as follows:

1. Stainless-steel door, cavity, and exterior.
2. Manual controls, for hot air, cool down, and off.
3. Timer.
4. Accessories:
 1. Wire racks.
 - 1) Quantity: [14].

B. Convection Oven Units:

SYMBOL	CAPACITY	HEAT SOURCE	SPECIAL ACCESSORIES
	Double compartment, full size	Electric	-

2.5 OVENS, COMBI

B. General Requirements: Combi ovens as follows:

1. Stainless-steel door, cavity, and exterior.
2. Manual controls, for hot air, cool down, and off.
3. Timer.
4. Accessories:
 1. Wire racks.
 - 1) Quantity: [12].

C. Convection Oven Units:

SYMBOL	CAPACITY	HEAT SOURCE	SPECIAL ACCESSORIES
	Double compartment, full size	Electric	-

2.6 URNS, COFFEE

A. General Requirements: Electric, twin coffee urns as follows:

1. Stainless-steel coffee compartment double-sided service.
2. Stainless-steel exterior insulated.
3. Two, sight glass for coffee and water and spigots dual sided.
4. Automatic controls.

- 5. Low water cut-off.
- 6. Stainless-steel filter basket.
- 7. Accessories:
 - 1. Water filter.
 - 2. Half brew.
- B. Urn, Coffee, Units:

SYMBOL	COMPARTMENTS/ CAPACITY
	Two/ 38 liter (10 gallons)

PART 3 - EXECUTION

3.1 INSTALLATION

- 1. Install cooking equipment level and plumb; arranged for safe and convenient operation; with access clearances required for maintenance and cleaning; and according to manufacturer's written instructions.
- 2. Interconnect cooking equipment to service utilities.

3.2 CLEAN-UP

- 1. At completion of the installation, clean and adjust cooking equipment as required to produce ready-for-use condition.
- 2. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS

- 1. Instruct personnel and transmit operating instructions in accordance with requirements in Section 00 72 13, GENERAL CONDITIONS.

END OF SECTION 11 44 00

SECTION 11 48 00 - CLEANING AND DISPOSAL EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies food service warewashing equipment as follows:
 - 1. Ventless Dishwashing machines, single tank, electric.

1.2 RELATED WORK

- A. Section 11 40 11, CUSTOM FABRICATED FOODSERVICE EQUIPMENT: Ware washing Tables.
- B. Section 22 11 13, FACILITY WATER DISTRIBUTION PIPING: Plumbing Connections.
- C. Section 22 13 13, FACILITY SANITARY SEWERS: Plumbing Connections.
- D. Section 22 42 26, COMMERCIAL DISPOSERS: Waste Disposers.
- E. Section 26 05 00, ELECTRICAL GENERAL PROVISIONS

1.3 QUALITY CONTROL

- A. Installer Qualifications: Licensed electrician and plumber either experienced with food service equipment installation or supervised by an experienced food service equipment installer.
- B. NSF Compliance: Equipment bears the NSF Certification Mark or UL Classification Mark indicating conformance with NSF/ANSI 3.
- C. UL Listing: Equipment has been evaluated according to UL 921, is listed and labeled by UL.
- D. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTALS
- B. Shop Drawings: Show dimensions, method of assembly, installation and conditions relating to adjoining work which requires cutting or close fitting, reinforcement, anchorage, and other work required for complete installation.
- C. Operating Instructions: In accordance with requirement in Section 01 33 00 SUBMITTALS and Section 00 72 13 GENERAL CONDITIONS.

1.5 WARRANTY

- A. Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction", FAR clause 52.246-21.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. NSF International/American National Standards Institute (NSF/ANSI):
3-2019 Commercial Ware washing Equipment
- C. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): 1767-2001 -
Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines.
- D. Underwriters Laboratories Inc. (UL):
921-06 Commercial Electric Dishwashers, including revision through and
including March 16, 2000

PART 2 - PRODUCTS

2.1 VENTLESS DISHWASHING MACHINES, SINGLE TANK, ELECTRIC

- A. General Requirements:
 - 1. Stainless-steel construction.
 - 2. Stainless-steel enclosure panels.
 - 3. Control panel.
 - 4. Electric tank heat.
 - 5. Capacity based on 508 by 508 mm (20 by 20 inch) racks.
 - 6. Accessories:
 - a. Built-in, electric booster heater that produces a 39 degrees C (70 degrees F) water-temperature rise.
 - b. Water-pressure regulating valve.
 - c. 686 mm (27 inch) wide door opening to accommodate trays and sheet pans.
 - 7. Provide Energy Star qualified appliances.
- B. Electric, Single-Tank Dishwashing Machine Units:

SYMBOL	CAPACITY RACKS/HOUR
	45

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install ware washing equipment, including controls and accessory equipment, arranged for safe and convenient operation and maintenance.
- B. Install ware washing equipment to prevent backflow of polluted water or waste into water supply system or into the warewashing equipment.
- C. Install and interconnect electrical controls and switches.

3.2 CLEAN-UP

- A. At completion of the installation, clean, lubricate, and adjust ware washing equipment as required to produce ready-for-use condition.
- B. Where stainless-steel surfaces are damaged during ware washing equipment installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS

- A. Instruct personnel and transmit operating instructions in accordance with requirements in Section 00 72 13, GENERAL CONDITIONS.

END OF SECTION 11 48 00

SECTION 12 21 13 – HORIZONTAL LOUVER BLINDS (BY ALTERNATE ONLY)

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Horizontal louver blinds with aluminum slats.

- B. Related Requirements:

- 1. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting horizontal louver blinds and accessories.
- 2. Division 26 Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized blind operation.

1.3 SUBMITTALS

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

- B. Shop Drawings: Show fabrication and installation details for horizontal louver blinds.

- C. Samples for Initial Selection: For each type and color of horizontal louver blind indicated.

- 1. Include similar Samples of accessories involving color selection.

- D. Samples for Verification: For each type and color of horizontal louver blind indicated.

- 1. Slat: Not less than 12 inches (300 mm) long.
- 2. Tapes: Full width, not less than 6 inches (150 mm) long.
- 3. Horizontal Louver Blind: Full-size unit, not less than 16 inches (400 mm) wide by 24 inches (600 mm) long.
- 4. Valance: Full-size unit, not less than 12 inches (300 mm) wide.
- 5. Cornice: Full-size unit, not less than 12 inches (300 mm) wide.

- E. Window Treatment Schedule: For horizontal louver blinds. Use same designations indicated on Drawings.

- F. Product Certificates: For each type of horizontal louver blind, signed by product manufacturer.

- G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency for each type of horizontal louver blind.

- H. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Flame-Resistance Ratings: Passes NFPA 701.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Product Standard: Provide horizontal louver blinds complying with WCSC A 100.1.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver horizontal louver blinds in factory packages, marked with manufacturer and product name, fire-test-response characteristics, lead-free designation, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 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. Horizontal Louver Blinds: Before installation begins, for each size, color, texture, pattern, and gloss indicated, full-size units equal to 5 percent of amount installed.

2. PRODUCTS

2.1 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Products (BOD): Subject to compliance with requirements, provide one of the following:
1. Hunter Douglas; CD88 Room Darkening 1" Horizontal Louver Blinds.
 - a. Hunter Douglas Contract/ 12250 Parkway Centre Dr. / Poway, CA 92064/ Phone: 800-727-8953 Fax: 800-205-9819/ Website: www.hunterdouglascontract.com, or architect approved equivalent. Contact David Cover for project assistance and dealer referral @ 800-964-2580, ext. #827313.
 2. Levolor, a Newell Rubbermaid Company; Kirsch/Levolor Mark I Room Darkening.
 3. Springs Window Fashions Division, Inc.; Springs/Bali S3000 Room Darkening.
- C. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile.
1. Width: 1 inch (25 mm).
 2. Finish: Brushed Aluminum as per approval of owner.
 - a. Ionized Coating: Antistatic, dust-repellent, baked polyester finish.
 - b. Reflective Coating: Manufacturer's special coating enhancing the reflection of solar energy on the outside-facing slat surface.
- D. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and end plugs and the following:
1. Capacity: One blind per headrail
 2. Integrated Headrail/Valance: Curved face.
 3. Light-blocking lower back lip.
 4. Tilt limiter with preselected degree settings.
- E. Bottom Rail: Formed-steel or extruded-aluminum tube, with plastic or metal capped ends top contoured to match crowned shape of slat with enclosed ladders and tapes to prevent contact with sill.
- F. Ladders: Evenly spaced to prevent long-term slat sag.
1. For Blinds with Nominal Slat Width 1 Inch (25 mm) or Less: Braided string.
 - a. Tape Color, Texture, and Pattern: Color, texture, and pattern as selected by Architect from manufacturer's full range.
- G. Lift Cords: Manufacturer's standard.
- H. Tilt Control: Enclosed worm-gear mechanism, slip clutch or detachable wand preventing over rotation and linkage rod, and the following:

1. Tilt Operation: Manual with clear plastic wand
 2. Length of Tilt Control: Manufacturer's standard.
 3. Tilt: Full.
- I. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.
 - J. Lift Operation: Manual, top-locking cord lock; locks pull cord to stop blind in either fully opened or fully closed position only and is equipped with a ring pull not more than 4 inches (100 mm) long.
 - K. Tilt-Control and Cord-Lock Position: Right and left side of headrail, respectively unless otherwise indicated.
 - L. Valance: PVC strip
 1. Finish Color Characteristics: Match color, texture, pattern, and gloss of slats
 - M. Mounting: Wall mounting permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated. **Surface-Mounted Horizontal Louver Blinds shall not be attached to the window system, Typ.**
 1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.
 - N. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.
 - O. Side Channels and Perimeter Light Gap Seals: Manufacturer's standard.
 - P. Colors, Textures, Patterns, and Gloss: As selected by Architect from manufacturer's full range

2.2 HORIZONTAL LOUVER BLIND FABRICATION

- A. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.
- B. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 1. Blind Units Installed between (inside) Jambs: Width equal to 1/4 inch (6 mm) per side or 1/2 inch (13 mm) total, plus or minus 1/8 inch (3.1 mm), less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm), less than head-to-sill dimension of opening in which each blind is installed.
 2. Blind Units Installed outside Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

- C. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, valance, and operating hardware, and for hardware position and blind mounting method indicated.
- D. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- E. Color-Coated Finish:
 - 1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
 - 2. Wood: Apply manufacturer's standard opaque factory-applied finish complying with manufacturer's written instructions for surface preparation, application, and minimum dry film thickness.
- F. Component Color: Provide rails, cords, ladders, and exposed-to-view metal, wood, and plastic matching or coordinating with slat color, unless otherwise indicated.

3. EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Install horizontal louver blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior slat edges in any position are not closer than 1 inch (25 mm) to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware if any.
- B. Flush Mounted: Install horizontal louver blinds with slat edges flush with finish face of opening if slats are tilted open.
- C. Jamb Mounted: Install headrail flush with face of opening jamb and head.
- D. Head Mounted: Install headrail on face of opening head.
- E. Recessed: Install headrail concealed within blind pocket.
- F. Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

- A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free of binding or malfunction throughout entire operational range.

3.4 CLEANING

- A. Clean horizontal louver blind surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged horizontal louver blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensure that horizontal louver blinds are without damage or deterioration at the 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 systems. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 12 21 13

SECTION 22 05 00 - BASIC PLUMBING REQUIREMENTS

1. GENERAL

1.1 SECTION INCLUDES

- A. This section describes Basic Mechanical Requirements required to provide for a complete installation of all mechanical 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 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.
- 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 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 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. Comply with provisions of ASME B31 Series "Code for Pressure Piping", including all addenda.
- D. 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. ACCA - Air Conditioning Contractors of America.
4. ADC - Air Diffusion Council.
5. AGA - American Gas Association.
6. AIHA - American Industrial Hygiene Association.
7. AMCA - Air Movement and Control Association.
8. ANSI - American National Standards Institute.
9. ARI - Air-Conditioning and Refrigeration Institute.
10. ASA - Acoustical Society of American.
11. ASHRAE - American Society of Heating, Refrigerating, and Air-Conditioning Engineers.
12. ASME - The American Society of Mechanical Engineers.
13. ASTM - American Society of Testing and Materials.
14. EJMA - Expansion Joint Manufacturers Association.
15. ICC – International Code Council.
16. NEBB - National Environmental Balancing Bureau.
17. NEC - National Electrical Code.
18. NEMA - National Electrical Manufacturers Association.
19. NFPA - National Fire Protection Association.
20. SAE - Society of Automatic Engineers.
21. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
22. UL - Underwriters Laboratories, Inc.
23. International Plumbing Code.
24. International Mechanical Code.
25. Other governing, state, and local codes that apply.

1.9 SUBMITTALS

- A. General: Follow the procedures specified in Divisions 0 and 1.
- 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:

Submittal Requirement:	Date Submitted:
Plumbing permits	
Plumbing licenses	
EPA/ASHRAE 34 refrigeration certification	
Warranties	
As-built documents	
Pipe pressure test logs	
Operation and maintenance manuals (electronic copies integrated into EMCS)	
Close-out / walk-through documentation	
Training seminar documentation	

2. Section 22 05 19:

Submittal Requirement:	Date Submitted:
Flow meters	
Calibrated balance valves	
Pressure gauges	

Submittal Requirement:	Date Submitted:
Thermometers	
Pressure/temperature test plugs	

3. Section 22 05 29:

Submittal Requirement:	Date Submitted:
Pipe supports, anchors, sleeves, and hangers	
Equipment curbs, supports, and hangers	
Mechanical seals	
Roof curbs and supports	

4. Section 22 05 53:

Submittal Requirement:	Date Submitted:
Plumbing identification materials	
Valve schedule	

5. Section 22 07 16:

Submittal Requirement:	Date Submitted:
Equipment insulation materials and insulation schedule	

6. Section 22 07 19:

Submittal Requirement:	Date Submitted:
Pipe insulation materials and insulation schedule	

7. Section 22 10 00:

Submittal Requirement:	Date Submitted:
Plumbing piping material and fitting schedule	
Plumbing valve material and schedule	
Plumbing pipe accessories	

Submittal Requirement:	Date Submitted:
Plumbing hydrostatic test report(s)	
Domestic water sample test report(s)	

8. Section 22 30 00:

Submittal Requirement:	Date Submitted:
All scheduled plumbing equipment	

9. Section 22 40 00:

Submittal Requirement:	Date Submitted:
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. 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 4 hours each, for each of the following items:
Domestic Water Heater WH-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 0. 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 0. In addition to the requirements specified in Division 0, 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 EMCS front-end system. Provide data in file types compatible with EMCS.

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.
- 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.

- B. Cutting and Patching
 - 1. General: Perform cutting and patching in accordance with Divisions 0 and 1. In addition to the requirements specified in these Divisions, 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, 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 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 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 floor mounted mechanical equipment. Concrete inertia pads shall be provided for all base-mounted pumps and air compressors installed in the penthouse area.
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. In exposed 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 in accordance with Section 09 91 00.

3.10 ELECTRICAL-PLUMBING EXTENT OF WORK

- A. 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 19 – PLUMBING METERS AND GAUGES

1. GENERAL

1.1 SECTION INCLUDES

- A. Water meters.
- B. Pressure gages and pressure gage taps.
- C. Thermometers and thermometer wells.
- D. Piping pressure and temperature test plugs.
- E. Sight flow indicators.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
- B. References
- C. Submittals
- 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 DOMESTIC WATER METER

- A. Construction shall comply with ANSI and AWWA C701 standards as required for domestic water metering applications.
- B. The measuring element shall consist of the transmission coupling, measuring element insert, rotor, inlet and outlet straightening vanes with nose cones, and calibration ring assembly. The register and measuring element shall be designed and constructed so that they may be removed without removing the meter housing from the installation. Meters shall be designed for maximum operating temperature of 120 degrees F and a maximum operating pressure of 150 PSI.
- C. Meter housing shall be cast bronze construction. Nose cone, straightening vanes and rotor shall be thermoplastic construction. Rotor thrust bearings shall be sapphire jewels and rotor bearing pivots shall be 316 stainless steel. Register lid and shroud shall be thermoplastic and bronze and trim shall be stainless steel.
- D. Transmission coupling between measuring element and meter register shall be ceramic magnetic direct drive.
- E. Register shall be a straight-reading odometer-type totalization display, 360 degree test circle with center sweep hand and flow finder to detect leaks. Register gearing shall consist of self-lubricating thermoplastic gears all permanently sealed. Registration for meters less than 6" shall be calibrated for 100,000,000 gallons @ 100 gallons/sweep hand revolution. Registration for meters 6" and larger shall be calibrated for 1,000,000,000 gallons @ 1,000 gallons/sweep hand revolution. Register shall be installed using either tamper detection seal wire screws or TORX tamper resistant seal screws. A tamper resistant calibration plug seal shall also be provided to protect from unauthorized personnel.
- F. Meters shall be provided with an integral 316 stainless steel strainer manufactured and installed into its inlet end complete with a removable cover plate which will permit easy access to the strainer for routine cleaning.
- G. Provide remote readout device if meter is installed greater than 5'-0" above finished floor. Mount remote readout device on wall at 5'-0" above finished floor.
- H. Provide interface with EMCS system to allow remote reading of meter usage.
- I. Meter: Points shall be displayed at integral LCD and as outputs to the EMCS. Coordinate all requirements with EMCS contractor.
- J. Insulation: Removable closed cell insulation, preformed to match meter housing.
- K. See Plumbing Equipment Schedules for specific performance requirements.

2.2 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.

2.3 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.

2.4 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).

2.5 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

2.6 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.

2.7 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 PIPING PRESSURE AND TEMPERATURE TEST PLUGS

- A. Test Plugs shall be nickel-plated brass body, with 1/2-inch NPS fitting and 2 self-sealing valve-type core inserts, suitable for inserting a 1/8-inch O.D. probe assembly from a dial-type thermometer or pressure gage. Test plug shall have gasketed and threaded cap with retention chain and body of length to extend beyond insulation. Pressure rating shall be 500 psig.
- B. Core Material: Conform to the following for fluid and temperature range:
 1. Air, Water, Oil, and Gas, 20 to 200 deg F (minus 7 to 93 deg C): Neoprene.

2.9 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 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.
- D. Connect water meters to EMCS for remote reading capability.
- E. Connect gas meter signal to EMCS for remote reading capability.

3.3 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.

3.4 TEST PLUGS

- A. Test Plugs: Install where indicated, located on pipe at most readable position. Secure cap.

3.5 FLOW MEASURING METERS

- A. Install where shown on plans and elsewhere as indicated. Provide manufacturer-recommended upstream and downstream straight distances.
- B. General: Install flow meters for piping systems located in accessible locations at most readable position. Maintain manufacturer-recommended minimum upstream and downstream distances.
- C. Window Flow Meters: Install in vertical upward position with impact tube mounted in bushing centered on pipe with 10 pipe diameters upstream and 5 pipe diameters downstream of straight unrestricted piping for 1-1/4 inches and smaller, 20 pipe diameters upstream and 10 pipe diameters downstream for 1-1/2 inches and larger. Calibrate meter after installation in accordance with manufacturer's installation instructions.

- D. Calibrate meter after installation in accordance with manufacturer's installation instructions.
- E. Connect meter to EMCS. Coordinate with controls contractor and provide all necessary interconnections for accurate transmission of data.

3.6 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. Pipe and equipment hangers, supports, stands, anchors, saddles and shields.
- B. Sleeves and seals.
- C. Mechanical sleeve seals.
- D. Mechanical seals.

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-69 – Pipe Hangers and Supports – Selection and Application.
- E. MSS SP-89 – Pipe Hangers and Supports – Fabrication and Installation Practices.

1.3 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING GUIDELINES

- A. References
- B. Submittals
- C. Delivery, storage and handling
- D. Quality Assurance

2. PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Plumbing Piping:
 - 1. Conform to International Plumbing Code, International Fuel Gas Code, ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89 as applicable.
- B. Natural Gas Piping:

1. Conform to International Fuel Gas Code, MSS SP58, MSS SP69, MSS SP89, as applicable.

C. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
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.

CI. Copper Pipe 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.

CII. Hangers and Supports:

1. Hangers for Hot and Cold Pipe Sizes 1/2 to 1-1/2 Inch, Carbon steel, adjustable swivel, band type.
2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 to 4 Inches; Carbon steel, adjustable, clevis.
4. , cast iron roll, double hanger.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
7. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
10. Vertical Support: Steel riser clamp.
11. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
12. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
14. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
15. Hangers for insulated pipe shall be enlarged to compensate for insulation thickness so that hangers support insulation. See Section 22 07 19.
16. Roof Support for Hot and Cold Pipe: See PIPE STANDS section below.
17. **Hangers for insulated pipe shall be enlarged to compensate for insulation thickness so that hangers support insulation. See Section 22 07 19.**

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, 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 for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturred lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.4 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)

2.5 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: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.

4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

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.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength

2.8 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.9 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Sleeves for Pipes Through Rated Floors and Walls: Schedule 40 steel pipe.

2.10 MECHANICAL SEALS

- A. Mechanical Seals: Modular mechanical type, consisting of interlocking EPDM synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with type 316 stainless steel bolts and reinforced plastic polymer pressure plates which cause rubber sealing elements to expand when tightened, providing a watertight and gas-tight seal and electrical insulation. Provide Advance Products & Systems Model Innerlynx or equivalent.+
 - 1. A sleeve shall be provided for each mechanical seal.
 - a. Thermoplastic sleeves: Sleeve shall have smooth walls and shall be made of molded non-metallic high density polyethylene (HDPE) with an integral solid water stop, Advance Products & Systems Model PWS or equivalent.
 - b. Steel sleeves: Sleeve shall have smooth walls, shall be made of Schedule 40 steel with an integral welded solid water stop, and shall have corrosion-resistant coating, Advance Products & Systems Model GWS or equivalent.
 - 2. Provide high-temperature silicone links rated for 400 Deg. F for steam and condensate applications.

3. EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.2 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.3 PIPE HANGERS AND SUPPORTS

- A. Reference applicable codes for maximum support spacing; see Section 22 0 500. Additional supports shall be provided at other locations as specified in this Section.
- B. Reference applicable codes for maximum support spacing; see Section 22 0 500. Additional supports shall be provided at other locations as specified in this Section.
- C. Support grooved pipe adjacent to each joint and at other locations per manufacturer recommendations.

- D. Support piping adjacent to large pipe accessories such as valves, air separators, traps, etc. Provide additional supports as recommended by accessory manufacturer.
- E. Independently support valves 16" and larger.
- F. Install all hangers, supports, and accessories that shall be attached to structural steel prior to the application of structural steel fireproofing. Repair fireproofing if damaged during remainder of project.
- G. Support horizontal piping as scheduled.
- H. Support fire protection systems piping independently from other piping systems. Fire main piping may be trapezed with other piping systems. Coordinate trapeze hangers with the Sprinkler Contractor.
- I. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- J. Place hangers within 12 inches of each horizontal elbow.
- K. Use hangers with 1-1/2 inch minimum vertical adjustment.
- L. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- M. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- N. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- O. Support riser piping independently of connected horizontal piping.
- P. Provide copper plated hangers and supports for non-insulated copper pipe.
- Q. Design hangers for pipe movement without disengagement of supported pipe.
- R. Prime coat steel hangers and supports in the mechanical room and other exposed areas. Refer to the Architectural reflected ceiling plans for location of exposed ceilings. Hangers and supports located in attic space, crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- S. Adjust hangers to distribute loads equally on attachments and to achieve specified pipe slopes.
- T. Space hangers for pure water and laboratory waste and vent systems to avoid pipe sags. Use manufacturer-recommended V-groove channel if necessary to maintain sag-free installation.
- U. Saddles, Shields and Inserts

1. Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
2. Install protective shields MSS Type 40 on cold piping that has vapor barrier. Shields shall span an arc of 180 degrees (360 degrees on trapeze hangers with U-bolt clamps) and shall have dimensions in inches not less than the following:

<u>NPS</u>	<u>LENGTH</u>	<u>THICKNESS</u>
1 through 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 through 14	24	0.075
16 through 24	24	0.105

3. Pipes 8 inches and larger shall have wood inserts.
 4. Insert materials shall be at least as long as the protective shield.
 5. Provide manufacturer-recommended saddles, inserts, and/or shields where cellular foam insulation is used. The removal of sections of cellular foam insulation for the purpose of pipe support is not acceptable.
- V. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- W. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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 A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- X. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- Y. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- Z. 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.
- AA. 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.
- BB. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- CC. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- DD. 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.
- EE. Install lateral bracing with pipe hangers and supports to prevent swaying.
- FF. 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.
- GG. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- HH. 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.
- II. 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. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 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: 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.
 - f. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

- g. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.4 INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and with AWS Standards D1.1.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to control movement to compensators.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.5 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls and floors.
- B. Flash floor drains in floors with topping over finished areas with CPE membrane, a minimum of 12 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- C. Seal floor, shower, mop sink, etc. drains watertight to adjacent materials.
- D. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.
- E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 SLEEVES

- A. Provide pipe and 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. At the Contractor's option, pipe sleeves may be omitted if the wall or floor is core drilled, except in areas potentially exposed to wet conditions (such as mechanical rooms, loading dock, generator room, penthouse, kitchen, etc.).
- C. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

- E. Sleeves through floors shall be grinded flush with finish floor level. In areas potentially exposed to wet conditions (such as mechanical rooms, loading dock, generator room, penthouse, kitchen, etc.), sleeve shall extend a minimum of 2" above finish floor.
- F. Where piping penetrates non-rated ceilings or walls, close off space between pipe or duct and adjacent work with urethane rod stock and caulk air tight.
- G. Seal pipe 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.
- H. Where piping 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.
- I. Install chrome plated steel escutcheons on piping at finished surfaces.
- J. Waste, vent and storm pipe penetrations through the concrete floor slab shall be encased in the poured concrete slab.
- K. PVC pipe casing around the cold and hot water and gas piping shall be encased in poured concrete when penetrating the floor slab. Seal the opening between the piping and PVC casing with putty or rigid polyisocyanurate insulation plug and seal with caulking.
- L. Provide mechanical seals and sleeves through exterior wall and floor penetrations and 3 hour or higher fire rated partitions.

3.7 HANGER SCHEDULES

MAXIMUM PIPE SIZE Inches	HANGER ROD HANGER SPACING Feet	DIAMETER Inches
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2
4 to 6	10	5/8
8 to 12	14	7/8
14 and Over	20	1
PVC (All Sizes)	6	3/8
C.I. Bell and Spigot (or No-Hub) and at Joints	5	

- A. Reference International Plumbing Code and International Fuel Gas Code where applicable.
- B. Reference manufacturer's recommendations for pure water piping and laboratory waste and vent piping.
- C. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- D. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- E. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- F. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
 - 1. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Pipe Hangers
 - a. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - b. 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.
 - c. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 - d. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - e. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - f. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 - g. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - h. 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 might occur.
 - i. 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 might occur.
 - j. Vee Bottom Clevis Hanger: For suspension of flexible plastic piping, Cooper B-Line B3106 or equivalent. Include plastic pipe support channel, Cooper B-Line B3106V.

2. Pipe Clamps

- a. 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.
- b. 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.
- c. Wall or Ceiling Mounted Pipe Strap/Clamp (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

3. Pipe Supports

- a. 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.
- b. 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.
- c. 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.
- d. Pipe Rollers (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- e. 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 might occur and vertical adjustment is not necessary.
- f. 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 might be required in addition to expansion and contraction.

J. 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.

K. 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 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.

L. 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. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes. Shall only be connected to bottom joist chord if weight is 200 lbs or less.
6. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads. Shall only be connected to bottom joist chord if weight is 200 lbs or less.
7. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions. Shall only be connected to bottom joist chord if weight is 200 lbs or less.
8. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel. Shall only be connected to bottom joist chord if weight is 200 lbs or less.
9. 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.
10. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. 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): For protection of pipe insulation; depth of saddle to be larger than insulation thickness. 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.

N. 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.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections.

P. Comply with MFMA-103 for metal framing system selections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.8 MECHANICAL SEALS

A. Provide mechanical seals and sleeves through exterior wall and floor penetrations, and in 3-hour or higher fire rated partitions.

3.9 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.

3.10 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.

3.11 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.

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.
- D. Ceiling Tacks/Stickers.

1.2 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING GUIDELINES

- A. References
- B. Related Sections
- C. Submittals
- D. Quality Assurance

1.3 PROJECT RECORD DOCUMENTS

- A. 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. Color: Conform to ASME A13.1.
- 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.
- 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.

2.4 CEILING TACKS/STICKERS

- A. Description: ½" self adhesive color coded stickers.
- B. Color code as follows:
 - 1. Yellow - HVAC equipment
 - 2. Red - Fire dampers/smoke dampers, sprinkler/standpipe system valves
 - 3. Green - Plumbing valves
 - 4. Blue - Heating/cooling valves

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 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.
- D. Identify air handling units, exhaust fans, chillers, pumps, heat generating, heat rejecting, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- E. Identify pressure reducing valves, backflow preventers, 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. For pipes $\frac{3}{4}$ " and smaller, identify piping with tags. 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. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
 - 1. Provide 14 gauge electrical tracer wire above all underground pipe (plastic or other type of utility piping).
- K. Provide ceiling stickers or machine generated labels to locate valves, dampers, or HVAC equipment above T-bar type panel ceilings. Locate ceiling sticker on the ceiling grid closest to equipment. Label each sticker with the device located above the ceiling, i.e. VBR-33.

END OF SECTION 22 05 53

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.
- 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
400	0.42
500	0.51

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; 0.08 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).

B. Aluminum Jacket: ASTM B209.

1. Thickness: 0.040 inch.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: PVC pre molded fittings.
5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

C. Stainless Steel Jacket: Type 304 or 316 stainless steel.

1. Thickness: 0.018 inch.
2. Finish: Smooth.
3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

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.**
- 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. Insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory applied or field applied.
 - 2. Insulate fittings, joints, flanges, unions strainers, flexible connectors and valves with molded insulation of like material and thickness as adjacent pipe. PVC or aluminum covers are required in all exposed locations as in mechanical rooms.
 - 3. Finish with glass cloth and vapor barrier adhesive.
 - 4. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 - 5. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- 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. PVC or aluminum covers are required in all exposed locations as in mechanical rooms.
 - 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. PVC covers are required in all exposed locations as in mechanical rooms.
 - 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 aluminum jacket and aluminum 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 23 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"
Refrigerant Piping	6" & smaller	1"
Cold Condensate Drain Piping	6" & smaller	1"
Plumbing Vents Within 20 Feet of the Exterior	All sizes	1"

3.6 CELLULAR FOAM 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	2"

Domestic Hot Water Recirc	1-1/4" & smaller	1"
Domestic Cold Water Supply	All sizes	1"
Cold Condensate Drain Piping	6" & smaller	1"
Refrigerant Piping	1-1/2" & smaller	1"
Refrigerant Piping	2" & larger	2"

END OF SECTION 22 07 19

SECTION 22 10 00 - PLUMBING PIPING

1. GENERAL

1.1 SECTION INCLUDES

- A. Pipe and pipe fittings.
- B. Valves.
- C. Sanitary waste and vent piping system.
- D. Water piping systems.
- E. Natural gas piping system.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
 - 1. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. References
- C. Submittals
- 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.
- 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 EXTRA MATERIALS

- A. Provide two repacking kits for each size valve.

2. PRODUCTS

2.1 SANITARY WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74, hub-and-spigot, service weight.
 - 1. Fittings: Cast iron, ASTM A74, service weight.
 - 2. Joints: ASTM C564 neoprene gasket system equivalent to Tyler Pipe Ty-Seal.
- B. PVC Pipe: ASTM D2665, solid-wall. Cellular core piping is not allowed. (Used only for fluid streams less than 120 Deg. F)
 - 1. Fittings: PVC, ASTM D2665, made to ASTM D3311, DWV patterns and to fit Schedule 40 pipe.
 - 2. Joints: Solvent cement, ASTM D2564; and adhesive purple primer, ASTM F656.

2.2 SANITARY WASTE AND VENT PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A888, hubless, service weight.
 - 1. Fittings: Cast iron, ASTM A888, service weight.
 - 2. Joints: Heavy-duty coupling with genuine neoprene gaskets, corrugated stainless steel shield, and stainless steel 4-band (4" and smaller) or 6-band (5" and larger) clamp-and-shield assemblies. Coupling shall meet ASTM C1540, ASTM C564, and FM 1680 Class 1.
- B. PVC Pipe: ASTM D2665, solid-wall. Cellular core piping is not allowed. (Used only for fluid streams less than 120 Deg. F)
 - 1. Fittings: PVC, ASTM D2665, made to ASTM D3311, DWV patterns and to fit Schedule 40 pipe.
 - 2. Joints: Solvent cement, ASTM D2564; and adhesive purple primer, ASTM F656.

2.3 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Tubing: ASTM B88, Type K, hard drawn.
 - 1. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper and bronze.
 - 2. Joints: AWS A5.8, BCuP silver braze.
 - a. Minimum 15% silver bearing filler material for copper-to-copper joints.
 - b. Minimum 45% silver bearing filler material for dissimilar metal joints.
- B. Ductile Iron (3" and larger)

1. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end. Pipe and fittings shall have ANSI/AWWA C104/A21.4, cement-mortar lining for ductile-iron pipe and fittings for water. Pipe and fittings shall also have ANSI/AWWA C105/A21.5, polyethylene encasement for ductile iron pipe systems. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper and bronze.
 - a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern. Provide manufacturer's restraining joint system equivalent to U.S. Pipe HP-Lok. Ductile Iron (3" and larger) Pex (buried and sleeved)
 - b. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated. Pipe and fittings shall have ANSI/AWWA C104/A21.4, cement-mortar lining for ductile-iron pipe and fittings for water. Pipe and fittings shall also have ANSI/AWWA C105/A21.5, polyethylene encasement for ductile iron pipe systems.
 - a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern. Provide manufacturer's restraining joint system equivalent to U.S. Pipe HP-Lok.
 - b. Gaskets: AWWA C111, rubber.

2.4 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. At contractor's option, mechanical pressed copper fittings may be used. Joints shall be double pressed type complying with ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements shall be EPDM and factory installed. Fittings shall be Viega, Mueller or approved equal.

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 GATE VALVES

A. 3 Inches and larger: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends. Class 125, MSS SP-70.

B. Gate valves used in potable water systems shall be lead-free construction. Refer to paragraph 1.3 REGULATORY REQUIREMENTS.

C. Chainwheel: On valves 6" and larger and installed higher than 8-feet above finished floor, provide sprocket rim, brackets, and chain compatible with valve.

2.10 BUTTERFLY VALVES

- A. 3 Inches and larger:
 - 1. Standard: MSS SP-67, Type I.
 - 2. CWP Rating: 200 psig.
 - 3. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
 - 5. Seat: EPDM or NBR.
 - 6. Stem: One- or two-piece stainless steel.
 - 7. Disc: Aluminum bronze or neoprene coated ductile iron.
 - 8. Valves used in potable water systems shall be lead-free construction. Refer to paragraph 1.3 REGULATORY REQUIREMENTS.

2.11 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.

2.12 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.

2.13 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.

2.14 ADJUSTABLE THERMAL BALANCING VALVE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product by Caleffi North America; ThermoSetter 116250AC, 116260AC Series or comparable product by one of the following:
 - 1. ThermOmegaTech.
 - 2. Viega.
- B. Description: Adjustable thermal balancing valve used for automatic balancing of recirculation circuits in domestic hot-water systems. Modulates flow rate in each circuit so hot-water temperature at fixtures remains constant. Models available with disinfection bypass cartridge to perform thermal disinfection to prevent Legionella.
- C. Standards:
 - 1. NSF/ANSI/CAN 372 low-lead laws, as certified by ICC-ES.
 - 2. NSF/ANSI/CAN 61, commercial hot water 180 deg F as certified by ICC-ES.
 - 3. Meets codes IPC and UPC.
- D. Maximum Working Pressure: 230 psig.
- E. Adjustable Working Temperature Range by Sizes:
 - 1. NPS 1/2 to NPS 3/4 for temperature range of 95 to 140 deg F
 - 2. NPS 1 and NPS 1-1/4 for temperature range of 95 to 150 deg F
- F. Body Material: DZR low-lead brass.
- G. Connections: NPT female threaded.
- H. Sizes: NPS 3/4 NPS 1
- I. Hydraulic Seals: Peroxide-cured EPDM.

- J. Adjustable Balancing Cartridge: Stainless steel and copper.
- K. ABS Adjustable Knob: Temperature adjustment scale for manual setting and tamper-proof adjustment locking screw.
- L. Factory Setting: 130 deg F. Refer to plans for final temp settings
- M. Disinfection Temperature:
 - 1. 160 deg F
- N. Closing Temperature:
 - 1. 170 deg F
- O. Flow Rating:
 - 1. 2.1 Cv, 1.2 Cv disinfection, 0.23 Cv minimum, 0.52 Cv design.
 - 2. 4.4 Cv maximum, 1.3 Cv disinfection, 1.0 Cv minimum, 1.9 Cv design.
- P. Outlet Temperature Gauge: 2-inch diameter with optional dual-scale outlet, 30 to 180 deg F
- Q. Check Valve: to be included
- R. Insulation shell to be included

2.15 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. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

- C. Route piping in orderly manner and maintain gradient.
 - D. Install piping to conserve building space and not interfere with use of space.
 - E. Group piping whenever practical at common elevations.
 - F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 - G. Vent pipes shall extend minimum 12" above finish roof line or as required by code.
 - H. Provide clearance for installation of insulation and access to valves and fittings.
 - I. Provide access where valves and fittings are not exposed.
 - J. Establish elevations of buried sanitary and storm piping outside the building to ensure not less than 3 ft of cover.
 - K. Establish elevations of buried water piping outside the building to ensure not less than 5 ft of cover.
 - L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - M. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.
 - N. Install bell and spigot pipe with bell end upstream.
 - O. Install valves with stems upright or horizontal, not inverted.
 - P. Extend chains on valves with chainwheel operators down to maximum 5-feet above finished floor.
 - Q. Install strainers in horizontal pipe or in vertical pipe such that flow is downward. Do not install strainers in vertical pipe with flow upward.
 - R. Install cast iron piping system according to CISPI Handbook.
 - S. Install copper tubing under building slab according to CDA's "Copper Tube Handbook." Install ball valve directly upstream of each floor slab penetration.
 - T. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.
- 3.4 APPLICATION
- A. Install unions downstream of valves and at equipment or apparatus connections.
 - B. Install valves for shut-off and to isolate equipment, part of systems, and vertical risers.

- C. Install ball valves for throttling, bypass, or manual flow control services.
- D. Provide spring loaded check valves on discharge of water pumps.
- E. Provide plug valves in natural gas systems for shut-off service.
- F. Provide flow control valves in water recirculating systems where indicated. Balance flow to maintain hot water at all plumbing fixtures.
- G. Natural Gas Piping:
 - 1. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
 - 2. 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.

3.8 SERVICE CONNECTIONS

- A. Provide new sanitary services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved backflow preventer and water meter with by-pass valves.
 1. Provide sleeve in wall for service main and seal at wall/floor with mechanical sleeve seals. Anchor service main inside to concrete wall/floor.
- C. Provide new gas service complete with gas meter and regulators.

END OF SECTION 22 10 00

SECTION 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for water service, fire-service mains and combined water service and fire-service mains.
- B. Utility-furnished products include water meters that will be furnished, ready for installation.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- E. NSF Compliance:
 - 1. Comply with NSF 14 for plastic potable-water-service piping.
 - 2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
1. Notify construction manager no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of water-distribution service without construction manager's written permission.

1.7 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. PVC, AWWA Pipe: AWWA C900, Class 200 with bell end with gasket, and with spigot end.
1. Comply with UL 1285 for fire-service mains if indicated.
 2. PVC Fabricated Fittings: AWWA C900, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
 3. PVC Molded Fittings: AWWA C907, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.2 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 GATE VALVES

- A. AWWA, Cast-Iron Gate Valves:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or a comparable product by one of the following:
 - a. American AVK Co.; Valves & Fittings Div.
 - b. American Cast Iron Pipe Co.; American Flow Control Div.
 - c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. East Jordan Iron Works, Inc.
 - f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

- g. McWane, Inc.; Kennedy Valve Div.
- h. McWane, Inc.; M & H Valve Company Div.
- i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.
- j. Mueller Co.; Water Products Div.
- k. NIBCO INC.
- l. U.S. Pipe and Foundry Company.
- m. Or approved equal.

4. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

- a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 250 psig
 - 3) End Connections: Push on or mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.

B. UL/FMG, Cast-Iron Gate Valves:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or a comparable product by one of the following:

- a. American Cast Iron Pipe Co.; American Flow Control Div.
- b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
- c. Crane Co.; Crane Valve Group; Stockham Div.
- d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).McWane, Inc.; Kennedy Valve Div.
- e. McWane, Inc.; M & H Valve Company Div.
- f. Mueller Co.; Water Products Div.
- g. NIBCO INC.
- h. U.S. Pipe and Foundry Company.
- i. Or approved equal

4. UL/FMG, Nonrising-Stem Gate Valves:

- a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig
 - 3) End Connections: Flanged.

2.4 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or a comparable product by one of the following:
 - a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
 - b. East Jordan Iron Works, Inc.
 - c. Flowserve.
 - d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - e. McWane, Inc.; Kennedy Valve Div.
 - f. McWane, Inc.; M & H Valve Company Div.
 - g. Mueller Co.; Water Products Div.
 - h. U.S. Pipe and Foundry Company.
 - i. Or approved equal.
 - j.
4. Description: Sleeve and valve compatible with drilling machine.
 - a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.5 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or a comparable product by one of the following:
 - a. American AVK Co.; Valves & Fittings Div.
 - b. American Cast Iron Pipe Co.; American Flow Control Div.
 - c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.

- d. American Foundry Group, Inc.
 - e. East Jordan Iron Works, Inc.
 - f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - g. McWane, Inc.; Kennedy Valve Div.
 - h. McWane, Inc.; M & H Valve Company Div.
 - i. Mueller Co.; Water Products Div.
 - j. Troy Valve; a division of Penn-Troy Manufacturing, Inc.
 - k. U.S. Pipe and Foundry Company.
 - l. Or approved equal.
4. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
- a. Standards: UL 246, FMG approved.
 - b. Pressure Rating: 150 psig minimum
 - c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
 - e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
 - f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping NPS 6 and NPS 8 shall be any of the following:
 - 1. PVC, AWWA Class 200 pipe; PVC, AWWA Class 200 molded fittings; and gasketed joints.
- F. Underground Fire-Service-Main Piping NPS 4 to NPS 8 shall be any of the following:
 - 1. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated or molded fittings; and gasketed joints.

2. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.
- G. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 10 shall be any of the following:
1. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC fabricated or molded fittings of same class as pipe; and gasketed joints.

3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 4 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Underground Valves, NPS 4 and Larger: AWWA, cast-iron, nonrising-stem, high-pressure, resilient-seated gate valves with valve box.
 2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.

3.4 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
- B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- C. Make connections larger than NPS 2 with tapping machine according to the following:
1. Install tapping sleeve and tapping valve according to MSS SP-60.
 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- D. Comply with NFPA 24 for fire-service-main piping materials and installation.
- E. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- F. Bury piping with depth of cover over top at least 60 inches with top at least 12 inches below level of maximum frost penetration.
- G. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

- H. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.5 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 - 1. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
 - 2. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.6 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 - 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 - 3. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

3.8 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. AWWA Fire Hydrants: Comply with AWWA M17.
- C. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.9 CONNECTIONS

- A. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve.
- B. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.10 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

3.11 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 20 00 "Earth Moving."

3.12 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 22 11 13

SECTION 22 11 19 - PLUMBING SPECIALTIES

1. GENERAL

1.1 SECTION INCLUDES

- A. Backflow preventers.
- B. Expansion tanks.
- C. Cleanouts.
- D. Water hammer arresters.
- E. Floor drains and floor sinks.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
- B. References
- C. Submittals
- 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.

1.4 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers
 - 1. Standard: ASSE 1013.
 - 2. Operation: Continuous-pressure applications.
 - 3. Body: Bronze for 2" and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for 2-1/2" and larger.
 - 4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 5. Accessories:

- a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
 - 6. Manufacturers: Watts, Zurn, or Febco.
- B. Double-Check Backflow-Prevention Assemblies:
- 1. Standard: ASSE 1015.
 - 2. Operation: Continuous-pressure applications, unless otherwise indicated.
 - 3. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 - 4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 5. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - 6. Manufacturers: Watts, Zurn, or Febco.

1.5 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Construction: Welded steel, tested and stamped in accordance with ASME SEC 8 D; supplied with National Board Form U 1, rated for working pressure of 125 psig, with flexible butyl rubber bladder sealed into tank and steel support stand.
- B. Accessories: Pressure gauge and air-charging fitting, tank drain.
- C. Manufacturer: Taco Series CA or equivalent.

1.6 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.

1.7 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.

1.8 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.

1.9 MANHOLES

- A. Formed Bottom Manholes: ASTM C 478; [concrete masonry units] [or] [reinforced precast concrete sections] laid on cast-in-place reinforced concrete foundation pad as specified in Section 03300.
 - 1. Size: [48] inch diameter.
 - 2. Cover: Standard cast iron with minimum sized pick hole, and frame. Use heavy duty cover and frame in vehicular traffic areas.

Steps: 3/4 inch diameter [galvanized steel] or [aluminum] on 16 inch centers.

1.10 OTHER SPECIALTIES

- A. Refer to Plumbing Fixture Schedule for required product information.

2. EXECUTION

2.1 PREPARATION

- A. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

2.2 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. Backflow Preventers:

1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to either building exterior or floor drain (coordinate with plans). Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
2. If equipped with a relief valve, pipe relief from backflow preventers to nearest drain. Piping diameter of drain piping shall match outlet diameter of air gap fitting.
3. Provide final certification for all testable backflow preventers, after installation, by certified cross connection device tester.

D. Water Hammer Arrestors:

1. Install water hammer arrestors complete with accessible isolation valve according to PDI-WH 201 and as shown on drawings.

E. 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.

2.3 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 13 13 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Nonpressure and pressure couplings.
 - 3. Expansion joints.
 - 4. Cleanouts.
 - 5. Encasement for piping.
 - 6. Manholes.

1.2 ACTION SUBMITTALS

- A. Product Data: For expansion joints.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. PVC Type PSM Sewer Piping:
 - 1. Pipe: ASTM D 3034, Schedule 40, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
 - 2. Fittings: ASTM D 3034, PVC with bell ends.
 - 3. Gaskets: ASTM F 477, elastomeric seals.

2.2 NONPRESSURE-TYPE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings:
 - 1. Description: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.3 CONCRETE

- A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Portland Cement Design Mix: 3500 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.4 MANHOLES

- A. Standard Precast Concrete Manholes:
 - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 2. Diameter: 48 inches minimum unless otherwise indicated.
 - 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 - 4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
 - 5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
 - 6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
 - 7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 - 8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.

9. Steps: Individual FRP steps; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum-width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.5 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 3500 psi minimum, with 0.50 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 3500 psi minimum, with 0.50 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 3500 psi minimum, with 0.5 maximum water/cementitious materials ratio.
 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure, drainage piping according to the following:
 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
 2. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
- G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 - 2. Join dissimilar pipe materials with nonpressure-type, flexible couplings.
- B. Pipe couplings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
 - 1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Unshielded flexible couplings for pipes of same or slightly different OD.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.4 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.5 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Install FRP manholes according to manufacturer's written instructions.
- D. Form continuous concrete channels and benches between inlets and outlet.
- E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.
- F. Install manhole-cover inserts in frame and immediately below cover.

3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Heavy-Duty, top-loading classification cleanouts in all areas.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains as specified in Division 22 specifications.
- B. Make connections to existing piping.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Protect existing piping to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 IDENTIFICATION

- A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
 - 1. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Re-inspect and repeat procedure until results are satisfactory.

- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
 - b. Option: Test concrete gravity sewer piping according to ASTM C 924.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.10 CLEANING

- A. Clean dirt and superfluous material from interior of piping.

END OF SECTION 22 13 13

SECTION 22 30 00 - PLUMBING EQUIPMENT

1. GENERAL

1.1 SECTION INCLUDES

- A. Domestic and laboratory water heat exchangers.
- B. Water softeners.
- C. Thermal mixing valves.

1.2 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING GUIDELINES

- A. References
- B. Submittals

1.3 QUALITY ASSURANCE

- A. See Section 22 05 00.
- B. Perform Work in accordance with State and Local standards.
- C. Provide pumps with manufacturer's name, model number, and rating/capacity identified.
- D. 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).
- E. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitations, are non-overloading in parallel or individual operation; operate within 25 percent of midpoint of published maximum efficiency curve.
- F. REGULATORY REQUIREMENTS
 - 1. Conform to ASME Section VIII D for manufacture of pressure vessels for heat exchangers.
 - 2. Conform to ASME Section VIII D for tanks.

1.4 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.5 WARRANTY

- A. Provide written five-year warranty from the date of Substantial Completion for repair or replacement of equipment components that fail in materials or workmanship.

1.6 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. Salt for Brine Tanks: Furnish in same form as and at least four times original load. Deliver on pallets. Deliver in pallets according to the following:
 - a. Food-Grade Pellet Salt in 50lb packages
 - b. Plain Pellet Salt in 50lb packages
 - c. Crystallized Solar Salt in 50lb packages
 - d. Plain, Brine Block Salt in 50lb blocks.
 - 2. Store salt on raised platform or pallet where directed by Owner. Do not store in contact with concrete floor.

2. PRODUCTS

2.1 Refer to Plumbing Equipment Schedules for performance requirements.

2.2 DOMESTIC WATER HEAT EXCHANGER (**NATURAL GAS**)

- A. Basis-of-Design Product: A.O. Smith Cylcone Xi
- B. Natural gas waters shall be 96% thermal efficiency. Storage capacity , input rating, and recovery rating shall match performance listed in Plumbing Equipment Schedule. Water heaters shall:
 - 1. Have seamless glasslined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded;
 - 2. Meet the thermal efficiency and standby loss requirements of the US Department of Energy and current edition of ASHRAE/IESNA 90.1.
 - 3. Have foam insulation and a CSA certified and ASME rated T&P relief valve;
 - 4. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up;
 - 5. Be approved for 0" clearance to combustibles.
- C. Heater shall be supplied with maintenance-free powered anode.
- D. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout. .
- E. Water heaters shall be design-certified by CSA International, according to ANSI Z21.10.3-CSA 4.3 standards governing storage-type water heaters.

- F. Water heaters shall be suitable for standard power venting using a 3" diameter PVC pipe.
- G. Water heaters shall incorporate the iCOMM system for remote monitoring, leak detection and fault alert.
- H. Warranty:
 - 1. Provide 5-year extended limited tank warranty.
- I. Alternative Manufacturers: Subject to compliance with requirements, provide one of the following:
 - 1. A. O. Smith
 - 2. Lochinvar Corporation.
 - 3. PVI Industries, LLC.
 - 4. Or equivalent.

2.3 WATER SOFTENERS

- A. Performance: See schedule on drawings.
- B. Softener Tank: Glass fiber reinforced plastic tank, 125 psig construction, NSF listed materials.
- C. Brine Tank: HDPE construction.
- D. Control: Control valve assembly shall be top-mount design with support package assembled to resin tank. Valve body shall be constructed from solid brass, capable of performing all system regeneration functions without the use of diaphragm valves. The piston control will open and close slowly to prevent hydraulic shock and noise. Controls shall be mounted in a gasketed, moisture-resistant enclosure with a NEMA 3R standard rating.
- E. Regeneration: A solid bronze meter shall be supplied on the outlet of the softener. The meter shall have an electronic interface with the main controls and will initiate regeneration on a volume basis or day override. Flow rate, totalizer, system status, time of day will be viewable from the meter control.

2.4 THERMAL MIXING VALVES

- A. Refer to Plumbing Equipment Schedule for performance requirements.
- B. Thermal mixing valves serving emergency fixtures to comply to ansi z.
- C. Manufacturer: Subject to compliance with scheduled requirements, provide product by one of the following:
 - 1. Powers
 - 2. Armstrong International, Inc.
 - 3. Leonard Valve Company
 - 4. Or equivalent.

3. EXECUTION

3.1 DOMESTIC WATER HEAT EXCHANGER INSTALLATION

- A. Install heat exchangers in accordance with manufacturer's instructions.
- B. Install unit with clearance for tube bundle removal without disturbing other installed equipment or piping.
- C. Install unit with manufacturer recommended clearances for service.
- D. Pipe relief valves and drains to nearest floor drain.
- E. Support unit on pipe stand or hang from structure above.
- F. Connect steam branch line from top of main. Pipe in flexible manner, pitched with steam flow, with pipe union connections. Provide steam pressure gauge at exchanger inlet.
- G. Provide steam traps and valves as indicated.

3.2 WATER SOFTENER INSTALLATION

- A. Install softeners and brine tanks in accordance with manufacturer's instructions.
- B. Pipe relief valves and drains to nearest floor drain.
- A. Equipment Mounting: Install water softeners on concrete base sized for unit.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 3. For 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.
 - 6. Anchor water softener and brine tanks to substrate.
- B. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.
- C. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

3.3 THERMAL MIXING VALVE INSTALLATION

- A. Install thermal mixing valve in accordance with manufacturer's instructions.
- D. Equipment Mounting: Install thermal mixing valve on 2" uni-strut.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.

3. For 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.
- E. Install thermal mixing valve and fittings furnished by equipment manufacturer but not specified to be factory installed.

3.5 FIELD QUALITY CONTROL

- A. 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.
- B. Water softeners will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

- A. Perform startup service.
1. Complete installation and startup checks according to manufacturers written instructions.
- B. Water Softeners

1. Add water to brine tanks and fill with salt per manufacturer recommendations.
 - a. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples), and prepare certified test reports for required water performance characteristics. Comply with the following:
 - 1) ASTM D 859, "Test Method for Silica in Water."
 - 2) ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
 - 3) ASTM D 1068, "Test Methods for Iron in Water."
 - 4) ASTM D 1126, "Test Method for Hardness in Water."
 - 5) ASTM D 1129, "Terminology Relating to Water."
 - 6) ASTM D 3370, "Practices for Sampling Water from Closed Conduits."

C. Thermal mixing valves

1. Follow manufacturer's recommendations for start-up and adjust outlet temperatures from valves to scheduled value.
2. For thermal mixing valves serving emergency fixtures, verify that valve still operates in the event of a hot water supply failure
 - a. If valve fails to supply water in event of hot water failure then valve shall be considered defective and shall be replaced/repaired.
3. Adjust circulation lines to scheduled flow and verify presence of scheduled tempered water at all fixtures.

D. Domestic water heat exchanger(s).

1. Follow manufacturer's recommendations for start-up and adjust outlet temperatures from water heat exchanger(s) to scheduled value.
2. Fill domestic / laboratory heat exchangers with water.
3. Charge domestic water / laboratory 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. Installation requirements of plumbing fixtures scheduled in Plumbing Fixture Schedule.
- B. Plumbing fixture carriers.

1.2 REFERENCE SECTION 22 05 00 FOR THE FOLLOWING GUIDELINES

- A. References
- B. Submittals
- C. Quality Assurance
- D. Delivery, Storage and Handling

1.3 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.
- B. The Contractor is responsible for ensuring that all roof drains are compatible with roof types and roof insulation. Refer to architectural and structural plans for roof information. No additional compensation will be allowed for failure to coordinate roof drains with roof types.

2.2 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 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. 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 for particular fixtures.

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 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.

3.5 URINAL INSTALLATION

A. Urinal Installation:

- 1) Install urinals level and plumb according to roughing-in drawings.
- 2) Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.

- 3) Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1. Coordinate exact locations with drawings.

b. Support Installation:

- 1) Install supports, affixed to building substrate, for wall-hung urinals.
- 2) Use off-floor carriers with waste fitting and seal for back-outlet urinals.
- 3) Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

c. Flushometer-Valve Installation:

- 1) Install flushometer-valve water-supply fitting on each supply to each urinal.
- 2) Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- 3) Install fresh batteries in battery-powered, electronic-sensor mechanisms.

d. Wall Flange and Escutcheon Installation:

- 1) Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
- 2) Install deep-pattern escutcheons if required to conceal protruding fittings.

e. Joint Sealing:

- 1) Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
- 2) Match sealant color to urinal color.

3.6 LAVATORY AND SINK INSTALLATION

- A. Install lavatories and sinks level and plumb according to roughing-in drawings.

- a. Install supports, affixed to building substrate, for wall-mounted lavatories and sinks.
- b. 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.
- c. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.
- d. Seal joints between lavatories/sinks, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.
- e. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks.
- f. Install water-supply piping with stop on each supply to each faucet.
 - 1) Exception: Use ball, gate, or globe valves if supply stops are not specified with lavatory/sink.
 - 2) Install stops in locations where they can be easily reached for operation.

3.7 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.8 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- C. Adjust water pressure at flushometer valves to produce proper flow.
- D. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.9 CLEANING

- A. Directly prior to project turnover, clean plumbing fixtures and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets, urinals, and fittings.
- C. Do not allow use of plumbing fixtures for use during construction unless approved in writing by Owner.

END OF SECTION 22 40 00

SECTION 22 42 26 - COMMERCIAL DISPOSERS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section specifies food waste machines as follows:
 - 1. Food waste disposers.

1.2 RELATED WORK

- A. Equipment with Food Waste Machines:
- B. Section 00 72 13, GENERAL CONDITIONS.
- C. Section 01 33 00, SUBMITTALS.
- D. Section 22 05 00, BASIC PLUMBING REQUIREMENTS.
- E. Section 22 13 13, FACILITY SANITARY SEWERS: Plumbing Connections.
- F. Section 26 05 19, CONDUCTORS: Electrical Connections.
- G. Section 26 27 26, WIRING DEVICES: Electrical Disconnect Switches.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by their basic designation only.
- B. American Welding Society (AWS):
 - D9.1M/D9.1-2012 Sheet Metal Welding Code
- C. NSF International (NSF):
 - 13-2012 Refuse Processors and Processing Equipment
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - Document 1767: Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines, 2001.
- E. Underwriters Laboratories Inc. (UL):
 - 430-2009 (R2011) Standard for Waste Disposers
 - UL Directory KVP-2010 Flammable and Combustible Liquids and Gases Equipment, Heating, Cooling, Ventilating, Cooking Equipment, Food Safety Equipment, Plumbing and Associated Products

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 00, SUBMITTALS.

- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 42 26, COMMERCIAL DISPOSERS", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
 - 1. Include manufacturer's address and telephone number.
 - 2. Include catalog or model numbers, illustrations and descriptions of food waste machines and accessories.
- D. Installation Drawings: Show dimensions; method of assembly; and details of installation, adjoining construction, coordination with plumbing and electrical work, and other work required for a complete installation.
- E. Operating Instructions: Comply with requirements in Section 00 72 13, GENERAL CONDITIONS.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Licensed electrician and plumber experienced with food service equipment installation or supervised by an experienced food service equipment installer.
- B. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with NSF 13.
- C. UL Listing: Equipment is evaluated according to UL 430 and listed in UL's Directory KVP and labeled for intended use.
 - 1. Products that contain features, characteristics, components, materials, or systems different from those covered by UL 430 shall be evaluated by UL using appropriate additional component and end-product requirements to maintain the level of safety anticipated by the intent of UL 430.
- D. Welding: Perform welding according to AWS D9.1M/D9.1.
- E. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

1.6 AS-BUILT DOCUMENTATION

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version on compact disc or DVD. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency

situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them on AutoCAD version 2013 provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
- D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

PART 2 – PRODUCTS

2.1 FOOD WASTE DISPOSER

- A. Food Waste Disposer Unit:
 - 1. Corrosion-proof construction housing and dual-direction shredding elements.
 - 2. Flow control.
 - 3. Solenoid valve.
 - 4. Vacuum breaker.
 - 5. Fixed nozzle.
- B. Motor:
 - 1. TEFC Motor (Totally Enclosed Fan Cooled) Construction.
 - 2. Built-In Thermal Overload Protection.
 - 3. Bearings sealed and lubricated.
- C. Control Panel:
 - 1. Autoreversing and internal time water flush.
 - 2. Stainless-steel mounting bracket.
- D. Pre-rinse:
 - 1. Backsplash mounted with hot- and cold-water mixing valve.
 - 2. Wall support bracket.
 - 3. Flexible 10 mm (3/8 inch) metal-encased hose supported by spiral spring, minimum length 737 mm (29 inches).
 - 4. Spray head assembly with lockable lever handle.
 - 5. Exposed metal parts are chrome plated or stainless steel.

E. Accessories:

1. Collar adaptor for sink.

F. Disposer Nomenclature:

SYMBOL	UNIT SIZE	CONE AND COVER SIZE	ACCESSORIES
K2332	2238 W (3 HP)	381 mm (15 inches)	Control panel spray rinse assembly
K2352	3730 W (5 HP)	381 mm (15 inches)	Control panel spray rinse assembly

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install food waste machines, including controls and accessory equipment, arranged for safe and convenient operation and maintenance per the manufacturer's written requirements.
- B. Install food waste machines to prevent backflow of polluted water or waste into water supply system or on to food preparation work surfaces.
- C. Install and interconnect electrical controls and switches.
- E. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no cost or additional time to the Government.

3.2 PROTECTING AND CLEANING

- A. Protect equipment from dirt, water, and chemical or mechanical injury prior to beginning work and during the remainder of the construction period. Any damage to existing equipment or surfaces shall be repaired/replaced at no additional cost or time to the Government.
- B. At completion of work, clean, lubricate, and adjust food waste disposers as required to produce ready-for-use condition.

3.3 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for one to two hours to instruct Personnel in operation and maintenance of the system.

END OF SECTION 22 42 26

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. Quality 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. EJMA - Expansion Joint Manufacturers Association.
 17. ETL - Engineering Tests Laboratory.
 18. ICC – International Code Council.

19. NEBB - National Environmental Balancing Bureau.
20. NEC - National Electrical Code.
21. NEMA - National Electrical Manufacturers Association.
22. NFPA - National Fire Protection Association.
23. NSF - National Sanitation Foundation.
24. SAE - Society of Automatic Engineers.
25. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
26. UL - Underwriters Laboratories, Inc.
27. International Plumbing Code.
28. International Mechanical Code.
29. Other governing, state, and local codes that apply.

1.9 SUBMITTALS

- A. General: Follow the procedures specified in Divisions 0 and 1.
- 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 0.

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 0 Section "General Conditions." 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 "HVAC 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 0 Section "General Conditions." 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 Divisions 0 and 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 required 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. 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.
2. 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.
3. Under no circumstances shall any structural members, load-bearing walls or footings be cut without first obtaining written permission from the Engineer.
4. 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.
5. Patching of concrete openings shall be filled with grout and finished smooth with the adjacent surface.
6. All below-grade openings for pipe shall be sealed with interlocking synthetic rubber line assembly, Link-Seal by Thunderline Corporation or equal.
7. Repair cut surfaces to match adjacent surfaces.
8. 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. Roof curbs, roof support for mechanical equipment and roof penetrations.

1. Verify, prior to submitting bid, the number, size, and location of all roof curb and roof supports and the location of all roof penetrations. Provide all roof deck-mounted equipment, pipe supports, and pipe penetrations. Cut roof deck for pipe and duct penetrations, unless noted otherwise. Provide all roof covering/membrane mounted equipment and pipe supports and roof drains, unless noted otherwise.
2. 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. All roof curbs, supports, and rails shall be sized to keep equipment a minimum of 18" above the roof insulation membrane in order to limit snow accumulation at or near equipment.

F. 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
3. Manual Motor Starters
4. Motor Connections
5. Capacitors
6. Safety Switches

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 SHEAVES

- A. All sheaves shall conform to NEMA Standard MG1-14.42, which lists minimum diameters and maximum overhangs. Locate motors to minimize overhang.
- B. When replacing sheaves, use sheaves of at least the originally supplied sizes.
- C. Contractor shall be responsible for replacement sheaves required to achieve specified performance. Coordinate with testing and balancing of the equipment.

2.3 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.
- 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.
- E. FULL VOLTAGE NON-REVERSING MAGNETIC STARTERS
1. See specification section 26 29 13 – Motor Controllers for requirements.
- F. FULL VOLTAGE NON-REVERSING COMBINATION STARTERS
1. See specification section 26 29 13 – Motor Controllers for requirements.
- G. MANUAL MOTOR STARTERS
- H. See specification section 26 29 13 – Motor Controllers for requirements.
- I. 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.

2.4 SAFETY SWITCHES

- A. See specification section 26 05 01 – Basic Electrical Materials and Methods.

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.

- B. Unless otherwise indicated on drawings, all motors, equipment, controls, etc. shall be furnished, set in place and wired in accordance with this specification section and the following schedule. Attached notes shall apply to schedule.

ITEM:	FURNISHED BY:	SET BY:	POWER WIRING BY:	TEMPERATURE CONTROL WIRING BY:
Equipment motors	MC	MC	EC	TC
Motor control centers	EC	EC	EC	TC
Unit-mounted motor starters, contactors, and overload heaters	MC	MC	EC	TC
Loose single speed, full-voltage, non-reversing motor starters, disconnect switches, thermal overloads and heaters	EC	EC	EC	TC
Loose two speed or reduced voltage motor starters, disconnect switches, thermal overloads and heaters	MC	MC	EC	TC
Manual operating multi-speed switches	MC	EC	EC	TC
Control relays and transformers	TC	TC	EC	TC
Control relays and transformers for LACS system	LACS	LACS	EC	TC
Thermostats and time switches	TC	TC	TC	TC
Temperature control panels	TC	TC	TC	TC
Variable frequency drives	MC or TC	MC	EC	TC
Motors and solenoid valves, damper motors, PE and EP switches	TC	TC	TC	TC
Refrigeration equipment	MC	MC	EC	TC
Pushbutton stations and connections	EC	EC	EC	TC
Temporary heating/cooling connections	MC	MC	EC	TC
Starters for control air compressors	TC	TC	EC	TC

SCHEDULE KEY: MC = Mechanical Contractor

EC = Electrical Contractor
 TC = Temperature Control Contractor

COORDINATION OF RESPONSIBILITIES FOR MECHANICAL, ELECTRICAL AND UNL FURNISHED SYSTEMS	NOTES: GC = GENERAL CONTRACTOR MC = MECHANICAL CONTRACTOR EC = ELECTRICAL CONTRACTOR BSM CG = BUILDING SYSTEMS MANAGEMENT CONTROL GROUP			
ITEM	FURNISHED BY	SET BY	POWER WIRING	CONTROL WIRING
Equipment Motors	MC	MC	EC	BSM CG
Motor Control Centers	EC	EC	EC	BSM CG
Unit Mounted Motor Starters, Contactors, Disconnect Switches, Thermal Overloads and Heaters	MC	MC	EC	BSM CG
Loose Motor Starters, Contactors, Disconnect Switches, Thermal Overloads and Heaters	EC	EC	EC	BSM CG
Pushbutton Stations and Safety Stop Switches – Air Handling Systems and Hydronic Systems	EC	EC	NA	BSM CG
Variable Speed Drives and Associated Safety Disconnects	BSM CG	EC	EC	BSM CG
Temporary Heating/Cooling and Connections	GC	MC/EC	EC	MC/EC
Chiller and Boiler Controls	MC	MC	EC	MC
Computer Room Air Conditioning Systems	MC	MC	EC	MC
Lab Ventilation Control Systems Air Valves	MC	MC	NA	NA
Lab Ventilation Control Systems Controls	BSM CG	BSM CG	BSM CG	BSM CG
Control Systems Compressed Air High Pressure Main Riser	MC	MC	NA	NA
Control Systems PRV Stations	BSM CG	MC	NA	BSM CG
Control Systems Compressed Air Mains 20PSI	BSM CG	BSM CG	NA	NA
Thermostats And Terminal Controls – Line Voltage	BSM CG	EC	EC	EC
Room Controls Transformer Panels	BSM CG	EC	EC	BSM CG
Thermostats And Terminal Unit Controls – Low Voltage	BSM CG	BSM CG	BSM CG	BSM CG
Air Terminal Units And Hydronic Reheat Coils	MC	MC	EC	NA
Air Terminal Units And Electric Reheat Coils	MC	MC	EC	NA
Automatic Flow Control Devices	MC	MC	NA	NA
System Controls Temperature Control Panels	BSM CG	BSM CG	EC	BSM CG
Air Handling And Hydronic Systems Controls	BSM CG	BSM CG	NA	BSM CG
Air Handling Systems Pressure Sensors	BSM CG	BSM CG	NA	BSM CG
Automatic Control Damper Actuators	BSM CG	BSM CG	NA	BSM CG
Automatic Control Dampers	BSM CG	MC	NA	BSM CG
Smoke/Fire Dampers	MC	MC	EC	BSM CG
Automatic Control Valves And Actuators	BSM CG	MC	NA	BSM CG
Air Handling Systems Air Flow Stations	BSM CG	BSM CG	NA	BSM CG
Hydronic Systems Temperature Sensor Wells	BSM CG	MC	NA	BSM CG
Hydronic And Steam Systems Pressure Taps	MC	MC	NA	NA
Hydronic And Steam Systems Pressure Sensors	BSM CG	MC	NA	BSM CG
Chilled Water Btu Meters	BSM CG	MC	EC	BSM CG
Heating Water Flow Meters	BSM CG	MC	NA	BSM CG

COORDINATION OF RESPONSIBILITIES FOR MECHANICAL, ELECTRICAL AND UNL FURNISHED SYSTEMS		NOTES: GC = GENERAL CONTRACTOR MC = MECHANICAL CONTRACTOR EC = ELECTRICAL CONTRACTOR BSM CG = BUILDING SYSTEMS MANAGEMENT CONTROL GROUP		
ITEM	FURNISHED BY	SET BY	POWER WIRING	CONTROL WIRING
Steam Condensate Meters	BSM CG	MC	EC	BSM CG
Steam Condensate Level Alarm	MC	MC	NA	BSM CG
Card Access Bldg Controllers	BSM CG	BSM CG	EC	BSM CG
Card Access Network Connections	GC	GC	NA	NA
Card Access Door Controllers	BSM CG	BSM CG	EC	BSM CG
Card Access Door Hardware	GC	GC	EC	BSM CG
Card Access Handicap Door Hardware	GC	GC	EC	BSM CG
Handicap Door Hardware (No Card Access)	GC	GC	EC	EC
Video Surveillance Bldg Computers	BSM CG	BSM CG	EC	BSM CG
Video Surveillance Network Connections	NA	NA	NA	NA
Video Surveillance Cameras	BSM CG	BSM CG	EC	BSM CG
Video Surveillance Circuits	BSM CG	BSM CG	EC	BSM CG
Security Systems Building Controllers	BSM CG	BSM CG	EC	BSM CG
Security Systems Communications Circuits	NA	NA	EC	BSM CG
Security Systems Field Devices	BSM CG	BSM CG	EC	BSM CG
Fire Alarm Panels	BSM CG	BSM CG	EC	BSM CG
Fire Alarm Communications Circuits	NA	NA	NA	NA
Fire Alarm Detectors, Pull Stations, Horns & Strobes	BSM CG	BSM CG	EC	BSM CG
Fire Alarm Cabling and Conduit	BSM CG	BSM CG	EC	BSM CG
Fire Alarm Relays	BSM CG	BSM CG	EC	BSM CG

END OF SECTION 23 05 13

SECTION 23 05 29 – HVAC HANGERS AND SUPPORTS

1. GENERAL

1.1 SECTION INCLUDES

- A. Pipe, ductwork, and equipment hangers, supports, anchors, saddles and shields.
- B. Mechanical flashing.
- C. Equipment curbs.
- D. Mechanical sleeves and seals.
- E. Flashing and sealing equipment and pipe stacks.
- F. Sealants, putty and compounds.
- G. Pipe Stands

1.2 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 PIPE HANGERS AND SUPPORTS

- A. Refrigerant Piping
 - 1. Conform to International Mechanical Code, ASME B31.1, ASTM F708, MSS SP58, MSS SP69, MSS SP89, as applicable.

B. Hangers and Supports:

1. Hangers for Hot and Cold Pipe Sizes 1/2 to 1-1/2 Inch, Carbon steel, adjustable swivel, band type.
2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 to 4 Inches; Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
7. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
10. Vertical Support: Steel riser clamp.
11. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
12. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
14. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
15. Roof Support for Hot and Cold Pipe: See PIPE STANDS section below.

2.2 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 Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- D. 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.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. 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.

2.3 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.

2.4 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)

2.5 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.6 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.

2.7 EQUIPMENT CURBS

- A. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, 1-1/2 inch thick insulation, factory installed wood nailer. Minimum 18 inch height, unless specified otherwise.

2.8 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.
- C. Sleeves for Round Ductwork: Galvanized steel.

- D. Sleeves for Rectangular Ductwork: Galvanized steel.

2.9 SEALANTS, PUTTY, AND COMPOUNDS

- A. Sealants:

- 1. Non fire/smoke rated partitions: Acrylic or silicone based caulking.

2.10 MECHANICAL SEALS

- A. Mechanical Seals: Modular mechanical type, consisting of interlocking EPDM synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with type 316 stainless steel bolts and reinforced plastic polymer pressure plates which cause rubber sealing elements to expand when tightened, providing a watertight and gas-tight seal and electrical insulation.

- 1. A sleeve shall be provided for each mechanical seal.
 - a. Thermoplastic sleeves: Sleeve shall have smooth walls and shall be made of molded non-metallic high density polyethylene (HDPE) with an integral solid water stop, Advance Products & Systems Model PWS or equivalent.
 - b. Steel sleeves: Sleeve shall have smooth walls, shall be made of Schedule 40 steel with an integral welded solid water stop, and shall have corrosion-resistant coating, Advance Products & Systems Model GWS or equivalent.

2.11 PIPE STANDS (ROOF)

- 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: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

- C. High-Type, Single-Pipe Stand:

- 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
- 2. Base: Plastic
- 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
- 4. Horizontal Member: Cadmium-plated-steel or stainless-steel with plastic or stainless-steel, roller-type pipe support.

- D. High-Type, Multiple-Pipe Stand:

- 1. Description: Assembly of Bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
- 2. Bases: One or more; plastic
- 3. Vertical Members: Two or more protective-coated-steel channels.
- 4. Horizontal member: Protective-coated-steel channel.
- 5. Pipe Supports: galvanized-steel, clevis-type pipe hangers.

- E. 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.

3. EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.2 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.3 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place hangers within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for non-insulated copper pipe.
- J. Design hangers for pipe movement without disengagement of supported pipe.

- K. Prime coat steel hangers and supports in the mechanical room and other exposed areas. Refer to the Architectural reflected ceiling plans for location of exposed ceilings. Hangers and supports located in attic space, crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- L. Adjust hangers to distribute loads equally on attachments and to achieve specified pipe slopes.
- M. Saddles, Shields and Inserts
 - 1. Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
 - 2. Install protective shields MSS Type 40 on cold piping that has vapor barrier. Shields shall span an arc of 180 degrees (360 degrees on trapeze hangers with U-bolt clamps) and shall have dimensions in inches not less than the following:

<u>NPS</u>	<u>LENGTH</u>	<u>THICKNESS</u>
1 through 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 through 14	24	0.075
16 through 24	24	0.105

- 3. Pipes 8 inches and larger shall have wood inserts.
- 4. Insert materials shall be at least as long as the protective shield.
- 5. Provide manufacturer-recommended saddles, inserts, and/or shields where cellular foam insulation is used. The removal of sections of cellular foam insulation for the purpose of pipe support is not acceptable.

3.4 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.

3.5 INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and with AWS Standards D1.1.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to control movement to compensators.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.6 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls and floors.
- B. Flash drains in floors with topping over finished area with lead, inches clear on sides with minimum 36 x 36 inch sheet size. Fasten to drain clamp device.
- C. Seal floor, shower, mop sink, etc. drains watertight to adjacent materials.
- D. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

3.7 SLEEVES

- A. At the Contractor's option, pipe sleeves may be omitted if the wall or floor is core drilled.
- B. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Sleeves through floors shall be grinded flush with finish floor level.
- E. Where piping or ductwork penetrate non-rated ceilings or walls, close off space between pipe or duct and adjacent work with urethane rod stock and caulk air tight.

- F. Provide on ductwork close fitting metal collar or escutcheon covers on the side of penetration that are exposed to view.
- G. Install chrome plated steel escutcheons on piping at finished surfaces.
- H. Provide mechanical seals and sleeves through exterior wall and floor penetrations and 3 hour or higher fire rated partitions.

3.8 HANGER SCHEDULES

- A. Reference International Plumbing Code and International Mechanical Code where applicable.

END OF SECTION 23 05 29

SECTION 23 05 53 - HVAC IDENTIFICATION

1. GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.
- D. Ceiling Tacks/Stickers.
- E. Duct Markers.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
- B. References.
- C. Submittals.
- 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 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. Color: Conform to ASME A13.1, latest revision
- B. Plastic Tape Pipe Markers: Minimum 1-1/2" letter size and 2-mil thickness, flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- 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.

2.4 CEILING TACKS/STICKERS

- A. Description: 1/2" self adhesive color coded stickers.
- B. Color code as follows:
 - 1. Yellow - HVAC equipment
 - 2. Red - Fire dampers/smoke dampers, sprinkler/standpipe system valves
 - 3. Green - Plumbing valves
 - 4. Blue - Heating/cooling valves

2.5 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 tags with corrosion resistant chain.

- C. 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.
- D. Identify air handling units, exhaust fans, chillers, pumps, heat generating, heat rejecting, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- E. Identify pressure reducing valves, backflow preventers, 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. Locations of 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. 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. TAB of plumbing systems.
- C. Measurement of final operating condition of mechanical and plumbing 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 Non-Pressurized Spaces: Adjust total to within 0 to +10 percent of design to space.
- C. Air Inlets in Non-Pressurized Spaces: Adjust total to within 0 to -10 percent of design from space.
- D. Plumbing Systems: Adjust to within +0 to 10 percent of design.

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. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 - Ductwork Accessories.
 - 3. 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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. 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.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. 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 Architect 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 DUAL-DUCT SYSTEMS

- A. Verify that the cooling coil is capable of full-system airflow, and set mixing boxes at full-cold airflow position for fan volume.
- B. Measure static pressure in both hot and cold ducts at the end of the longest duct run to determine that sufficient static pressure exists to operate controls of mixing boxes and to overcome resistance in the ducts and outlets downstream from mixing boxes.
 - 1. If insufficient static pressure exists, increase airflow at the fan.
- C. Test and adjust the constant-volume mixing boxes as follows:
 - 1. Verify both hot and cold operations by adjusting the thermostat and observing changes in air temperature and volume.
 - 2. Verify sufficient inlet static pressure before making volume adjustments.
 - 3. Adjust mixing boxes to indicated airflows within specified tolerances. Measure airflow by Pitot-tube traverse readings or by measuring static pressure at mixing-box taps if provided by mixing-box manufacturer.
- D. Do not overpressurize ducts.
- E. Remeasure static pressure in both hot and cold ducts at the end of the longest duct run to determine that sufficient static pressure exists to operate controls of mixing boxes and to overcome resistance in the ducts and outlets downstream from mixing boxes.
- F. Adjust variable-air-volume, dual-duct systems in the same way as constant-volume, dual-duct systems; adjust maximum- and minimum-airflow setting of each mixing box.

3.8 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.

3.9 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.10 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the refrigerant charge.
 - 4. Check the condition of filters.
 - 5. Check the condition of coils.
 - 6. Check the operation of the drain pan and condensate-drain trap.
 - 7. Check bearings and other lubricated parts for proper lubrication.
 - 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.
 - 4. Fans are clean.
 - 5. Bearings and other parts are properly lubricated.
 - 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
 - 1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 - 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 - 3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 - 4. Balance each air outlet

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.
- 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. 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).

F. 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).

G. Thermal Mixing Valve Test Reports: For thermal mixing valves 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 (L/s).
- g. Water pressure differential in feet of head or psig (kPa).
- h. Recirculation pump information:
 - 1) Pump rpm.
 - 2) Impeller diameter in inches.
 - 3) Motor make and frame size.
 - 4) Motor horsepower and rpm.
 - 5) Voltage at each connection.
 - 6) Amperage for each phase.
 - 7) Full-load amperage and service factor.
 - 8) Seal type.

2. Test Data (Indicated and Actual Values):

- a. Final system discharge temperature.

b. Recirculation pump information:

- 1) Pump rpm.
- 2) Impeller diameter in inches.
- 3) Motor make and frame size.
- 4) Motor horsepower and rpm.
- 5) Voltage at each connection.
- 6) Amperage for each phase.
- 7) Full-load amperage and service factor.
- 8) Seal type.

3.12 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. Duct liner.
- C. Insulation jackets.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. References.
- B. Submittals.
- 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).

2.2 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.

1. 'K' value: ASTM C518, 0.23 at 75 degrees F.
2. Maximum service temperature: 250 degrees F.
3. Maximum moisture absorption: less than 3 percent by volume.
4. Density (concealed locations): 3.0 lb/cu ft.
5. Density (exposed locations): 6.0 lb/cu ft.

B. Vapor Barrier Jacket

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm.
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 acrylic based adhesive.

2.3 CELLULAR FOAM

A. Insulation: ASTM C534; flexible, cellular elastomeric, sheet.

1. 'K' ('ksi') Value: ASTM C177 or C518; 0.27 at 75 degrees F.
2. Minimum Service Temperature: -40 degrees F.
3. Maximum Service Temperature: 220 degrees F.
4. Maximum Moisture Absorption: ASTM D209; 0.2 percent by volume.
5. Moisture Vapor Transmission: ASTM E96; 0.08 perm-inches.
6. Maximum Flame Spread: ASTM E84; 25.
7. Maximum Smoke Developed: ASTM E84; 50.
8. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 DUCT LINER

A. Liner Material:

1. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - a. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - b. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - 1) For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 - a. 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.
 - b. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - 1) For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Natural-Fiber Duct Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor and complying with NFPA 90A or NFPA 90B.
 - a. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested according to ASTM C 518.
 - b. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to ASTM E 84; certified by an NRTL.
 - c. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - 1) For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick material matching ductwork material (galvanized steel, aluminum, stainless steel); with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Securing method in first subparagraph below is for ducts with air velocities of 2500 fpm (12.7 m/s) and lower. Use caution when designing lined ducts with air velocities higher than 2500 fpm (12.7 m/s). See SMACNA for requirements.
8. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
9. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

2.5 EXTERIOR DUCT INSULATION

A. Laminated Cellular Foam; closed cell foam insulation with metal covering.

1. 'K' ('ksi') Value: ASTM C177 or C518; 0.25 at 75 degrees F.
2. Minimum Service Temperature: -297 degrees F.
3. Maximum Service Temperature: 180 degrees F.
4. Maximum Moisture Absorption: ASTM D209; 0.2 percent by volume.
5. Moisture Vapor Transmission: ASTM E96; 0.05 perm-inches.
6. Connection: Waterproof vapor barrier adhesive.
7. Armaflex Armatuff Sheet Insulation or equivalent.

B. 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. Field applied jacketing: MFM FlexClad 400 or equivalent; 40 mil thickness.
 - a. Aluminum jacket with high-density cross-linked polymer film.
 - b. Aggressive Asphalt adhesive.

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. Duct Liner Application:
 - 1. Install in accordance with SMACNA HVAC Duct Construction Standard and all manufacturer recommendations.
 - 2. Adhere insulation with adhesive for 100 percent coverage.
 - 3. Secure insulation with mechanical liner fasteners if recommended by manufacturer. Refer to SMACNA Standards for spacing.
 - 4. Seal and smooth joints.
 - 5. Seal liner surface penetrations, tears or raw edges with adhesive.
 - 6. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.
- M. Exterior Insulation Application:

1. Laminated closed cell foam:
 - a. Install in accordance with manufacturer's recommendation.
 - b. Utilize product compliant adhesives or pre-applied pressure sensitive adhesives.
 - c. Cover seams with product compliant seal tape.

2. 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):
Exposed rectangular outside air duct in mechanical rooms and chases	Rigid	2"	Y
Exposed rectangular supply air duct in mechanical rooms and chases	Rigid	2"	Y
Exposed round supply air duct in mechanical rooms	Flexible	2"	Y
Exposed rectangular and round return air duct in mechanical rooms	None required unless shown on plans		
Exposed rectangular and round exhaust air duct upstream of heat recovery system in mechanical rooms	None required unless shown on plans		
Exposed rectangular and round exhaust/relief air duct downstream of heat recovery system in mechanical rooms	Rigid	2"	Y
Exposed rectangular and round return air duct or exhaust air duct in other areas	None required unless shown on plans		
Exposed rectangular and round supply air duct upstream of terminal units	Flexible	2"	Y
Exposed rectangular supply air duct downstream of terminal units	Liner	1-1/2"	Y
Exposed round supply air duct downstream of terminal units	Flexible	2"	Y
Concealed rectangular and round supply air duct upstream of terminal units	Flexible	2"	Y
Concealed rectangular outside air duct	Flexible	2"	Y
Concealed rectangular supply air duct downstream of terminal units	Liner	1-1/2"	Y
Concealed round supply air duct downstream of terminal units	Flexible	2"	Y
Concealed return air duct upstream of terminal	Liner	1"	Y

Ductwork Application:	Type:	Thickness:	Vapor Barrier Required (Y/N):
units			
Concealed exhaust air duct	None required unless shown on plans		
Return air grille boots/transfer ducts (where indicated on drawings)	Liner	1"	N
Exterior Ductwork	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 23 00 - REFRIGERANT PIPING AND SPECIALTIES

1. GENERAL

1.1 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Basic HVAC Requirements.
- B. Section 23 05 29 – HVAC Hangers and Supports.

1.3 REFERENCES

- A. Reference Section 23 05 00.

1.4 SUBMITTALS

- A. Reference Section 23 05 00.

1.5 PROJECT RECORD DOCUMENTS

1.6 OPERATION AND MAINTENANCE DATA

- A. Reference Section 23 05 00.

1.7 QUALIFICATIONS

- A. Reference Section 23 05 00.

1.8 REGULATORY REQUIREMENTS

- A. Conform to ASHRAE Standard 15 for refrigerant regulations.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Reference Section 23 05 00.

2. PRODUCTS

2.1 PIPING

- A. Copper Tubing: ASTM B280, Type ACR hard drawn or annealed. Tubing shall be factory cleaned, ready for installation and have ends capped to protect cleanliness of pipe interiors prior to shipping.

1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8 BCuP 15% silver minimum/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

- B. Pipe Supports and Anchors:

1. Provide in accordance to Section 23 05 29 HVAC Hanger and Supports.

2.2 REFRIGERANT

- A. Refrigerant: ASHRAE 34.

1. Shall be R-410A, no equivalent.

2.3 CELLULAR FOAM INSULATION

- A. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.

1. 'K' ('ksi') Value: ASTM C177 or C518; 0.27 at 75 degrees F.
2. Minimum Service Temperature: -40 degrees F.
3. Maximum Service Temperature: 220 degrees F.
4. Maximum Moisture Absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.
5. Moisture Vapor Transmission: ASTM E96; 0.20 perm inches.
6. Maximum Flame Spread: ASTM E84; 25.
7. Maximum Smoke Developed: ASTM E84; 50.
8. Connection: Waterproof vapor barrier adhesive.

- B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

3. EXECUTION

3.1 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.

3.2 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space.
- D. Group piping whenever practical at common elevations and locations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
 - 1. Install in accordance with Section 230529 – HVAC Hangers and Supports.
- G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required.
- H. Provide clearance for installation of insulation and access to valves and fittings.
- I. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 230500.
- J. Flood piping system with nitrogen while brazing.

3.3 COMMISSIONING

- A. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
- B. Fully charge completed system with refrigerant after testing.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 230500.
- B. Test refrigeration system in accordance with ASME B31.5.
- C. Pressure test system with dry nitrogen to 200 psig. Perform final tests at 250 microns vacuum. Test to no leakage.

3.5 CELLULAR FOAM INSULATION SCHEDULE

PIPING SYSTEMS	PIPE SIZE	THICKNESS
Refrigerant Suction	All sizes	1/2"

Factory supplied insulated refrigerant line set may be used.
Coat cellular foam insulation located outside with two coats of K-Flex® 374 protective coating or equivalent product compatible with insulation.

END OF SECTION 23 23 00

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. Seismic-restraint devices.
 - 5. Duct cleaning.
 - 6. Duct pressure testing.

B. Insulated flexible ductwork.

C. Louver backpans.

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. SMACNA - HVAC Air Duct Leakage Test Manual.
 - d. SMACNA – HVAC Duct Construction Standards - Metal and Flexible.
 - e. SMACNA - Round Industrial Duct Construction Standards
 - f. International Mechanical Code, current edition.

B. References.

C. Submittals.

- 1. Submit detailed CAD-generated ductwork detail drawings at minimum ¼" 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.

D. Performance requirements.

1. No variation of duct configuration or sizes shall be permitted except by written permission.
2. Structural Performance: Duct hangers, supports, and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7. SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." Reference Structural Design Criteria on General Structural Note Sheet in Structural Drawings for seismic hazard level classification.
 - a. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
 - b. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
 - c. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

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. Gasket material shall be chemical resistant material in all fume exhaust ductwork.
 - 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 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. 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. Gasket material shall be chemical resistant material in all fume exhaust ductwork.
 - 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.
 3. 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.
 4. 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.
 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.
 6. 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. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
5. 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. DUCT LINER

1. See 23 07 13 Ductwork Insulation specification.

E. 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.

F. 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.

2.3 LOUVER BACKPAN

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.
- B. Construct of 18-gage galvanized steel using continuous external welded joints.
- C. Welded ductwork is to be welded with filler rod of the same material as the metal that is being welded. Prime coat and paint welded joints with cold galvanized paint.
- D. Slope bottom to prevent accumulation of water. Provide drains where shown on drawings.

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.
- G. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- H. 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.
- I. 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.
- J. Construct and install each duct system for the specific duct pressure classification indicated.
- K. Install only low loss high efficiency fittings at takeoffs. Extractors not allowed.
 - 1. Air terminal take-offs from rectangular main ducts shall be lo-loss 45° 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.
- L. Install couplings tight to duct wall surface with a minimum of projections into duct.
- M. Install ducts with a clearance of 2 inch, plus allowance for insulation thickness.
- N. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- O. 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.
- P. Coordinate routing with all other trades to establish space requirements for each.

- Q. 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.
- R. 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.
- S. 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.
- T. 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.
- U. 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.
- V. Where required on drawings, install automatic control dampers as recommended by the manufacturer.
- W. Prevent passage of unfiltered air around filters with felt, rubber, neoprene gaskets, or other approved safing material.
- X. 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.
- Y. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- Z. 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.
- AA. Change duct sizes gradually, not exceeding 30 degrees (15 degrees ideally) divergence and 45 degrees (30 degrees ideally) convergence.
- BB. 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.
- CC. Provide return air grilles open to ceiling plenum with duct boot with minimum longitudinal dimension 2' X 2'.

- DD. Provide flexible connect between ductwork and all moving equipment.
 - 1. Provide 1-inch slack for free movement.
- EE. 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.
- FF. Unless otherwise noted, provide maximum of 6' of flexible duct upstream of each diffuser or grille. See details on Drawings.
- GG. Cover all exposed fiberglass insulation with duct tape.

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. All mitered elbows shall be equipped with turning vanes.
- B. 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.

- C. All diverging flow fittings shall be constructed such that no excess material projects from the body into the branch tap entrance.
- D. 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:
Outside air system	Galv. Steel	3A	4A, 4C	-2"	B	24	
Rectangular SA system	Galv. Steel	3A, 3B, 3E	4A, 4C, 4D	+2"	A	24	8B
Round SA system	Galv. Steel	3C, 3E	4B, 4D	+2"	A	12	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	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
 - d. 25% of the fume exhaust 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 access doors.
- C. Duct test holes.
- D. Flexible duct connections.
- E. Manual balancing dampers.
- F. Gravity backdraft dampers.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. References.
- B. Submittals.
- 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.
- G. Extra materials.
 - 1. Provide two of each size and type of fusible link for fire and combination fire/smoke dampers.

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.

2.2 DUCT ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Double wall, rectangular door.
2. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
3. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches : Four hinges and two compression latches with outside and inside handles.
 - e. Fabricate doors airtight and suitable for duct pressure class.
4. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

2.3 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.

2.4 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Materials: Flame-retardant or noncombustible fabrics.

- C. 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. Fume Exhaust System, Flexible Connectors: Glass fabric with chemical-resistant coating.
 - a. Minimum Weight: 14 oz./sq. yd.
 - b. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
 - c. Service Temperature: Minus 67 to plus 500 deg F.
 4. 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.

2.5 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.

2.6 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.

2.7 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. On both sides of duct coils.
 2. Upstream from duct filters.
 3. At outdoor-air intakes and mixed-air plenums.
 4. At drain pans and seals.
 5. Downstream from control dampers, backdraft dampers, and equipment.
 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 7. Upstream or downstream from duct silencers.
 8. Control devices requiring inspection.
 9. 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.

END OF SECTION 23 33 00

SECTION 23 37 00 - AIR OUTLETS AND INLETS

1. GENERAL

1.1 SECTION INCLUDES

- A. Diffusers.
- B. Registers/grilles.
- C. Louvers.
- D. Goosenecks.

1.2 REFERENCES

- A. See Section 23 05 00.

1.3 SUBMITTALS

- A. See Section 23 05 00.

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 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.

2.2 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.

2.3 LOUVERS

- A. General: Except as otherwise indicated, provide manufacturer's standard units where shown; of size, shape, capacity, finishes, and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide units that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with schedules.
- C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.
- D. Provide units with 1/2 inch square mesh for exhaust and 3/4 inch for intake birdscreens. Install such that screens are easily removable from an accessible location.

2.4 ROOF HOODS

- A. General: Except as otherwise indicated, provide manufacturer's standard units where shown; of size, shape, capacity, finishes, and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide units that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with schedules.
- C. Mount roof hoods on minimum 24" high insulated curb bases unless otherwise noted.
- D. Provide units with 1/2 inch square mesh for exhaust and 3/4 inch for intake birdscreens.

2.5 GOOSENECKS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, of minimum 18 gage type 304 welded stainless steel, unless otherwise noted.
- B. Mount on minimum 12 inch high curb base where size exceeds 9 x 9 inch. Terminate gooseneck minimum 36" above roof.

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.
- F. Provide return air sound boot on grilles as shown on drawings.

END OF SECTION 23 37 00

SECTION 23 38 13 – COMMERCIAL KITCHEN HOODS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes Types I and II commercial kitchen hoods.

1.3 DEFINITIONS

- A. Listed Hood: A hood tested according to UL 710 by a testing agency acceptable to authorities having jurisdiction.
- B. Standard Hood: A hood that complies with design, construction, and performance criteria of applicable national and local codes.
- C. Type I Hood: A hood designed for grease exhaust applications.

1.4 SUBMITTALS

- A. Refer to 01 33 00 Submittals specification for required submittals.
- B. Product Data: For the following:
 - 1. Hoods.
 - 2. Grease removal devices.
 - 3. Fire-suppression systems.
 - 4. Lighting fixtures.
- C. Shop Drawings:
 - 1. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
 - 2. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
 - 3. Indicate performance, exhaust and makeup air airflow and pressure loss, at actual Project-site elevation.
 - 4. Indicate method of attaching hangers to building structure.
 - 5. Show exhaust and makeup air ducts, and fittings connecting to hoods.
 - 6. Show water-supply and drain piping.
 - 7. Show control cabinets.
 - 8. Show fire-protection piping, actuation devices, and manual control devices.
 - 9. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 10. Wiring Diagrams: Power, signal, and control wiring.

- D. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Include roughing-in requirements for drain connections. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.
- E. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Relative location of ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings to hoods and accessory equipment.
 - 2. Roof framing and support members for duct penetrations.
 - 3. Ceiling suspension assembly members.
 - 4. Size and location of initial access modules for acoustical tile.
- F. Welding certificates.
- G. Field test reports.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel," for hangers and supports; and AWS D9.1, "Sheet Metal Welding Code," for joint and seam welding.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. NSF Compliance: Fabricate hoods according to NSF 2, "Food Equipment."
- E. SMACNA Compliance:
 - 1. Fabricate hoods to comply with SMACNA's "HVAC Duct Construction Standards: Metal and Flexible," second edition.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish required dimensions using approved food facility equipment Shop Drawings. Coordinate fabrication with food facility equipment manufacturer to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate equipment layout and installation with other Work, including light fixtures, HVAC equipment, and fire-suppression system components.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish one complete set of grease removal devices.

2. PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Commercial Kitchen Hoods:
 - a. Captive-Aire Systems.
 - b. EconAir
 - c. Greenheck
 - d. Halton
 - 2. Wet-Chemical Fire-Suppression Systems:
 - a. Ansul Incorporated; a Tyco International Ltd. Company.
 - b. Badger Fire Protection, Inc.
 - c. Fenwall Safety Systems, Inc.; Div. of Kidde Technologies, Inc.

2.2 HOOD MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - 1. Minimum Thickness: 0.03 inch.
 - 2. General: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
 - 3. Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - 4. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
 - 5. Exposed Surfaces: ASTM A 480/A 480M, No. 3 finish (intermediate polished surface).
- B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.
- C. Galvanized Steel Sheet: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
 - 1. Minimum Thickness: 0.03 inch.
- D. Zinc-Coated Steel Shapes: ASTM A 36/A 36M, zinc coated according to ASTM A 123/A 123M requirements.

- E. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR, Section 177.2600, for use in areas that come in contact with food.
 - 1. Color: As selected by Architect from manufacturer's full range.
 - 2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.
- F. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch thickness that does not chip, flake, or blister.
- G. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and passes testing according to UL 710.

2.3 HOOD FABRICATION, GENERAL

- A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
 - 1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
 - 2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
 - 3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
 - 4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
 - 5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.
- B. For metal butt joints, comply with SMACNA's "Kitchen Equipment Fabrication Guidelines."
- C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.
- D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
- E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
- F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.
- G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.
- H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.

- I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.
- J. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Equipment Fabrication Guidelines."
- K. Fabricate enclosure panels to ceiling and wall as follows:
 - 1. Fabricate panels on all exposed sides with same material as hood, and extend from ceiling to top of hood canopy and from canopy to wall.
 - 2. Wall Offset Spacer: Minimum of 3 inches.
 - 3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Equipment Fabrication Guidelines," with minimum 0.0625-inch- thick, stainless-steel shelf tops.

2.4 TYPE I EXHAUST HOOD FABRICATION

- A. Weld all joints exposed to grease with continuous welds and make grease removal devices and makeup air diffusers easily accessible for cleaning.
 - 1. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
 - 2. Exhaust-Duct Collars: Minimum 0.0625-inch- thick stainless steel at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a 0.5-inch-wide duct flange.
- B. Hood Configuration: Exhaust only.
- C. Hood Style: Wall-mounted canopy.
- D. Grease Removal Devices: Removable, stainless-steel, filter/baffle grease filters with spring-loaded fastening. Fabricate with minimum 0.0781-inch- thick stainless steel for filter frame and removable collection cup and trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall comply with UL 1046, "Grease Filters for Exhaust Ducts."
- E. Removable Grease Extractor: Removable, stainless-steel extractor, at least 0.0781 inch thick. Hood with extractor must be tested according to UL 710.
- F. Light Fixtures: UL-listed, LED fixtures. Wiring shall be installed in stainless-steel conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc on cooking surface below hood.
 - 1. Switches shall be mounted on wall adjacent to hood.
 - 2. Fluorescent Lighting Fixtures: Comply with UL 1570.
- G. Wet-Chemical Fire-Suppression System: Preengineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
 - 1. Steel Pipe, NPS 2 and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.

3. Pipe Covers: Chrome-plated aluminum tubing.
 4. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on wall. Furnish manual pull station for wall mounting adjacent to hood. Exposed piping shall be covered with stainless-steel sleeves. Exposed fittings shall be chrome plated.
 5. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
 6. Furnish an electric-operated, gas shutoff valve with clearly marked open and closed indicator for field installation.
 7. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
 8. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters.
- H. Hood Controls: Single, wall-mounting control cabinet shall control groups of adjacent hoods and shall be fabricated of stainless steel.
1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with fire-suppression system to operate fans during fire-suppression-agent release and to remain in operation until manually stopped.
 2. Kitchen Control system shall be a UL listed outlet center which shall standardly consist of a NEMA-1 Stainless Steel Enclosure within a Stainless Steel Enclosure Panel, Printed Circuit Board (PCB), Full Color Touchscreen User Interface, hood, audible alarm, sensor(s) and Variable Frequency Drive(s) (VFD) or Motor Starters, with options for room temperature sensors and fan control through relays or 0-10 VDC signals. The PCB shall be capable of controlling multiple exhaust and supply fans via VFDs or analog signals. The control system shall utilize a combined control panel and hood light power connection with options for 110-120V / 50-60Hz / 1Ph input voltage or 220-240V / 50-60Hz / 1Ph input voltage, to be protected by a 15 Amp breaker. The control system shall be equipped with either Modbus or BACnet MSTP Building Management interfacing, and also be able to control up to 8 different ECM fans, alongside a 3-phase makeup air unit, without the need for added expansion boards or controllers. Standard Kitchen Control enclosure fitted with handled, quarter-turn, slotted latched doors, or optional prison package configuration with handled, tamper-proof quarter turn latched doors.
 3. The user interface shall be a full color touch screen with fan and light control, gas valve reset (optional), and balancing interfacing for proper kitchen fan balancing. The touchscreen shall have the capability to simultaneously control all fans and lights connected to the control panel with a single button. The touch screen shall be configured to push fit into a junction box, with no visible/exposed screws.
 - a. In the event of the failure consisting of, but not limited to temperature sensor(s), VFD(s) and fire, the touch screen will automatically go to a fault page, which will describe the current fault. The fault will remain until the failure is corrected.
 - b. The touchscreen shall be lighted, full color, and utilize simple plug and play connections. Touchscreen shall be mounted on the exhaust hood, a utility cabinet on the hood or wall, or shipped loose for remote mounting. If touchscreen is shipped loose for remote mounting, it shall be provided alongside optional 50ft or 100ft plug and play CAT5E cable for connection to main control PCB. All touchscreen mounting options will set the full color touchscreen centered on a stainless-steel faceplate, with no visible screws or fasteners on the faceplate.
 4. The variable volume (DCV: Demand Control Ventilation) Kitchen Controls shall utilize resistive type temperature sensors that are mounted in the capture tank of the hood to monitor exhaust air temperatures, and an optional room temperature sensor, shipped loose, to be installed to detect ambient air temperatures in the kitchen space.

- Temperature sensors shall be made of stainless steel and shall be installed in a UL approved coupling.
5. The system shall be capable of serving as an IMC compliant auto start-up control to automatically start the fans during cooking operations. Auto start-up operation is controlled by the measurement of an excess offset temperature between the exhaust temperature caused by cooking and the ambient room temperature in the kitchen (default offset temperature: 10°F, adjustable). If not equipped with a room temperature sensor, auto start-up operation shall be controlled by the measurement of an excess offset temperature between the exhaust temperature caused by cooking and the constant, preset room temperature (default preset room temperature set point: 75°F, adjustable. Default offset temperature: 10°F, adjustable. Default auto start-up initiates at 85°F as measured by the hood temperature sensor(s)). If any fan(s) are activated through the auto start-up operation, the fan(s) will not shut off automatically until the measured hood temperature(s) remain [temp interlock hysteresis]°F below the room temperature (preset or actual) for the length of the hysteresis timer (default temp interlock hysteresis: 5°F, adjustable. Default hysteresis timer: 5 minutes).
 6. After fan initiation is triggered, either manually, through the touchscreen, or through the auto start-up operation, the controller shall modulate the speed of the fans via VFD(s) or analog signal(s), from maximum speed down to a minimum speed percentage (minimum speed to be determined by building test and balance, minimum speed is factory defaulted to 50%). After fan initiation is triggered, the initial activation temperature is recorded as the room temperature at activation plus the offset temperature (default offset temperature: 10°F, adjustable). If not equipped with a room temperature sensor, the activation temperature shall be recorded as the preset room temperature plus the offset temperature (default preset room temperature set point: 75°F, adjustable. Default offset temperature: 10°F, adjustable. Default activation temperature shall be 85°F as measured by the hood temperature sensor(s)). Speed modulation of the fans shall be controlled through the difference between activation temperature and the highest current temperature recorded at the hood temperature sensor(s). Minimum fan speed shall occur when the current hood temperature equals the activation temperature, and maximum fan speed shall occur when the current hood temperature is equal to or exceeds the activation temperature plus the modulation temp range (modulation temp range default: 30°F, adjustable). Speed control shall be controlled through VFD(s) or analog signal(s) shall allow modulation of the fan speeds. The controller must be compatible with modulating turndown of up to 50% of maximum fan speed. Upon pressing the “Max Fan” button, exhaust fan speeds shall go to maximum speed for 10 minutes (adjustable), or until the “Max Fan” button is pressed again, which shall return the system to full temperature control.
 7. If provided, variable frequency drives shall be Yaskawa brand (or equivalent) mounted in the control enclosure, a utility cabinet, or at the exhaust/supply fan itself. If variable frequency drives are mounted within the control enclosure, enclosure shall be equipped with a cooling fan and louver to facilitate ventilation for the variable frequency drives. Variable drives shall provide thermal overload protection to fans and eliminate the need for magnetic starters for 3 phase motors. To ensure proper building pressurization, the supply fans shall respond to changes in the exhaust fans speeds. The speed of the associated supply fan(s) is either determined by the weighted average percent speed of that supply fan(s) associated exhaust fan(s) (default) or is controlled by maintaining the original design exhaust/supply CFM differential.
 8. In a fire condition, the control panel shall be capable of forcing the exhaust to maximum speed, shutdown of supply air, and shutdown of lights regardless of current fan speeds via integration with a fire system.

3. EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation.

- B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install hoods level and plumb.
- B. Complete field assembly of hoods where required.
 - 1. Make closed butt and contact joints that do not require filler.
 - 2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in Part 2 "General Hood Fabrication" Article.
- C. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, grease removal devices, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.
- D. Make cutouts in hoods where required to run service lines and to make final connections.
- E. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.
- F. Install hoods to operate free from vibration.
- G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.
- H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.
- I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

3.3 CONNECTIONS

- A. Duct Connections: Comply with applicable requirements in Division 23 Section "Duct Accessories" for flexible connectors on makeup air supply duct. Weld exhaust-duct connections.
- B. Fire-Suppression Piping: Install piping connections for remote-mounted suppression systems according to NFPA 17, "Wet Chemical Extinguishing Systems."
- C. Ground equipment.
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Test motors and rotating equipment for proper rotation and lubricate moving parts according to manufacturer's written instructions.
 - 4. Test liquid-carrying and water, drain, and gas components for leaks. Repair or replace leaking components.

- B. Remove malfunctioning units, replace with new units, and retest as specified above.

3.5 ADJUSTING

- A. Set initial temperatures, and calibrate sensors.

- B. Set field-adjustable switches.

3.6 CLEANING

- A. Remove protective coverings and clean and sanitize hoods and associated services, both inside and out, according to manufacturer's written instructions.

- B. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hoods. Refer to Division 23.

END OF SECTION 23 38 13

SECTION 23 51 00 - BREECHINGS, CHIMNEYS, AND STACKS

1. GENERAL

1.1 SECTION INCLUDES

- A. Listed Type B Vents
- B. Non-foam core CPVC pressure pipe.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. References.
- B. Submittals.
 - 1. Product Data: For the following:
 - a. Special gas vents
 - b. Building-heating-appliance chimneys
 - c. Non-foam core CPVC pressure pipe
 - 2. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and seismic restraints, and location and size of each field connection.
 - 3. Welding certificates.
 - 4. Warranty: Special warranty specified in this Section.
- C. Quality Assurance.
 - 1. Source Limitations: Obtain listed system components through one source from a single manufacturer.
 - 2. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.
 - 3. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.
- D. Coordination.
 - 1. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code, NFPA 54 (ANSI Z223.1) code for installation of natural gas burning appliances and equipment.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., or testing firm acceptable to the authority having jurisdiction] as suitable for the purpose specified and indicated.

2. PRODUCTS

2.1 LISTED TYPE B VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Schebler
 - 2. Selkirk Inc.
 - 3. Metal-Fab Inc.
 - 4. Or equivalent.
- B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 Deg F continuously for Type B with neutral or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch (6-mm) airspace.
- D. Inner Shell: ASTM B 209 (ASTM B 209M), Type 1100 aluminum.
- E. Outer Jacket: Galvanized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
- G. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.

2.2 NON-FOAM CORE CPVC PRESSURE PIPE

- A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
 - 1. Charlotte Pipe
 - 2. Spears Manufacturing
 - 3. Genova
 - 4. Or equivalent.
- B. Pipe and fittings shall be manufactured from virgin rigid CPVC (chlorinated polyvinyl chloride) vinyl compounds with a Cell Class of 24448 as identified in ASTM D 1784.
- C. CPVC pipe and fittings shall conform to ASTM D 2846. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer. All pipe and fittings shall be manufactured in the United States. Pipe and fittings shall conform to National Sanitation Foundation (NSF) Standards 14 and 61.

3. EXECUTION

3.1 EXAMINATION AND STORAGE

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Store delivered materials inside, out of the weather. Protect materials from accidental damage or vandalism.

3.2 INSTALLATION - GENERAL

- A. Installation shall comply with latest installation instructions published by the manufacturer and shall conform to all local plumbing, building and fire code requirements. Solvent weld joints shall be made using CPVC cement conforming to ASTM F 493. Yellow one-step cement may be used without primer. If a primer is required by local plumbing or building codes, then a primer conforming to ASTM F 656 should be used. The system shall be protected from chemical agents, fire stopping materials, thread sealant, plasticized vinyl products or other aggressive chemical agents not compatible with CPVC compounds.
- B. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- C. Support at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- E. Lap joints in direction of flow.
- F. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.
- G. Maintain minimum clearances from combustibles specified in UL listing.
- H. Level and plumb chimney and stacks.
- I. At appliances, provide slip joints permitting removal of appliances without removal or dismantling of breechings, breeching insulation, chimneys, or stacks.
- J. Finish: All aluminized surfaces exposed to the atmosphere shall be protected by a minimum of one base coat and one finish coat of paint.

3.3 SCHEDULES

A.	<u>EQUIPMENT</u>	<u>System</u>
	Water Heater	Listed B VENT
	Infrared Heater	Listed B VENT
	Furnaces	Non-Foam Core CPVC Pressure Pipe

3.4 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- B. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- C. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 23 51 00

SECTION 23 54 00 – FURNACES AND HEAT PUMPS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Gas-fired, condensing furnaces and accessories complete with controls.
 - 2. Air filters.
 - 3. Heat Pumps.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:
 - 1. Furnace.
 - 2. Thermostat.
 - 3. Air filter.
 - 4. Heat pumps.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals for each of the following:
 - 1. Furnace and accessories complete with controls.
 - 2. Air filter.
 - 3. Heat Pumps.

- D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

- C. ASHRAE/IESNA 90.1-2010 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2010, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:
 - 1. Warranty Period, Commencing on Date of Substantial Completion:
 - a. Furnace Heat Exchanger: 5 years.
 - b. Refrigeration Compressors: 10 years.

1.7 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. Disposable Air Filters: Furnish two complete sets.

2. PRODUCTS

2.1 GAS-FIRED FURNACES, CONDENSING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carrier Corporation; Div. of United Technologies Corp.
 - 2. Lennox Industries Inc.
 - 3. Trane.
 - 4. York International Corp.; a division of Unitary Products Group.
- B. General Requirements for Gas-Fired, Condensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.
- C. Cabinet: Steel.
 - 1. Cabinet interior around heat exchanger shall be factory-installed insulation.
 - 2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
 - 3. Factory paint external cabinets in manufacturer's standard color.
 - 4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- D. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.

1. Fan Motors: Comply with requirements in specifications.
 2. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
- E. Type of Gas: Natural
- F. Heat Exchanger:
1. Primary: Aluminized steel.
 2. Secondary: Stainless steel.
- G. Burner:
1. Gas Valve: 100 percent safety single-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
 2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
- H. Gas-Burner Safety Controls:
1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
 3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
- I. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings pre-purges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
- J. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories, diagnostic light with viewport.
- K. Accessories:
1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through roof.
 2. CPVC Plastic Vent Materials.
 - a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F 441/F 441M.
 - b. CPVC Plastic Fittings: Schedule 40, complying with ASTM F 438, socket type.
 - c. CPVC Solvent Cement: ASTM F 493.
- L. Capacities and Characteristics:
1. Airflow Configuration: Upflow.
 2. Gas:
 - a. Type: Natural
 - b. Venting Type: Power venter with combustion-air intake.
 - c. Minimum Efficiency AFUE: 95 percent.
 - d. Vent Material: CPVC.

2.2 THERMOSTATS

- A. Solid-State Thermostat: Wall-mounting, programmable, microprocessor-based unit with:
1. Seven (7) day programming capability with 2 occupied/unoccupied periods per day.
 2. Automatic heat/cool change over.
 3. Start time optimization
 4. Continuous fan operation in occupied mode.
 5. Intermittent fan operation in unoccupied mode.
 6. Battery backup
 7. Temporary override capability
 8. Locking setpoints to prevent tampering.
 9. Anti-recycle controls
 10. Touch screen/color display.
 11. 365 day scheduling
 12. Historical System info
 13. WiFi enabled with mobile applications and users accounts
 14. 14. Remote programming through web portal
 15. 15. Two dry contact inputs (programmable operation)
- B. Control Wiring: Unshielded twisted-pair cabling.
- C. Controls shall comply with requirements in ASHRAE/IESNA 90.1-2004, "Controls."

2.3 AIR FILTERS

- A. Disposable Pleated Filters: Farr 20/20 or equivalent. Mount filter in slide rack with hinged door and latch in return duct work.

2.4 HEAT PUMP UNITS UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier Corporation; Div. of United Technologies Corp.
 2. Lennox Industries Inc.
 3. Trane.
 4. York International Corp.; a division of Unitary Products Group.
- B. Products/Systems: including the following equipment:
1. All units to be factory assembled, wired and piped
 2. All units to be assembled in the USA
 3. All units to be factory tested prior to shipping
- C. Cabinet:
1. Heavy-gauge steel construction
 2. Corrosion free pre-painted cabinet finish
 3. Corrosion free pre-painted base section
 4. Compressor and control box
 - a. Located in separate compartment inside unit
 - b. Insulated with thick fiberglass insulation

- 1) Control box with controls factory wired
- 2) Large removable service access panel
- 3) Base drainage holes for moisture removal
- 4) High density polyurethane unit support feet
- 5) Coil protection panels
- 6) Steel construction
- 7) Hinged
- 8) Louvered
- 9) May be completely removable

D. Refrigerant Line Connections, Electrical Inlets, Service Valves:

1. Sweat connection vapor and liquid lines located on cabinet corner
2. Fully serviceable brass service valves
3. Full shutoff vapor valve
4. Liquid valve can be front seated to manage refrigerant charge while servicing system
5. Vapor and liquid line service valve to be located inside unit
6. Suction and liquid line gauge ports to be located inside unit
7. Refrigerant line connections and field wiring inlets to be located in one central area

E. Controls:

1. Defrost Control

F. Options:

1. Indoor Blower Speed Relay Kit
2. Time Delay Relay Kit
3. Low Ambient Control Option (down to 30° F)
 - a. Compressor Low Ambient Cutoff
 - b. Compressor Lock-out thermostat

G. Compressor:

1. Single Stage
2. Scroll type
3. Resiliently mounted on rubber mounts for vibration isolation
4. Internal excessive current and temperature protection
5. Crankcase heater
6. Outdoor Thermostat Kit – Field installed

H. Refrigerant System:

1. Refrigerant: R410-a
2. Units to come pre-charged

I. Outdoor Coil Fan:

1. Direct drive fan
2. Vertical air discharge
3. Totally enclosed fan motor with sleeve bearings
4. Inherently protected fan motor
5. Corrosion resistant PVC coated steel fan guard

6. Removable fan guard for fan service access

J. Copper Tube/Fin Coil:

1. Copper tube
2. Flared shoulder connections
3. Silver solder construction
4. Lanced, ripple-edged aluminum fins
5. Coil is leak tested at factory

K. Entire coil to be accessible for cleaning Standard factory installed features:

1. Expansion valve to be factory piped
2. Discharge temperature switch
3. High pressure switch
4. Low pressure switch
5. Hi-capacity liquid line drier
6. Four (4) – way reversing valve
7. Freezestat that opens at 29° F and closes at 58° F
8. Refrigerant Line Kit

L. Installer must:

1. Set heat pump
2. Connect refrigerant lines
3. Charge refrigerant circuit.
4. Make electrical connections

3. EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
- B. Install oil-fired furnaces and associated fuel and vent piping according to NFPA 31.
- C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

1. Anchor furnace to substrate to resist code-required seismic acceleration.
- D. Controls: Install thermostats at mounting height of 60 inches above floor.
- E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.
- F. Install ground-mounted, compressor-condenser components on 4-inch thick, reinforced concrete base; 4 inches larger on each side than unit. Coordinate anchor installation with concrete base.
- G. Install in accordance with manufacturer's instructions.
- H. Protect units with protective covers during balance of construction.
- I. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.
- J. Provide for connection to electrical service. Refer to Section 262726.
- K. Provide connection to refrigeration piping system and evaporators. Refer to Section 232300. Comply with ASHRAE 15.
- L. Furnish charge of refrigerant and oil.
- M. Install units in accordance with manufacturer's instructions and regulations of authorities having jurisdiction.

3.3 CONNECTIONS

- A. Connect gas piping with union or flange and appliance connector valve.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.
 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 4. Slope pipe vent back to furnace or to outside terminal.
- D. Connect ducts to furnace with flexible connector.
- E. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.

1. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

- F. Comply with requirements in Division 23 Section "Refrigerant Piping" for installation and joint construction of refrigerant piping.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- B. Verify that flexible connections properly dampen vibration transmission to structure.

3.5 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for physical damage to unit casings.
2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust flexible connections.
6. Verify that controls are connected and operational.
7. Supply initial charge of refrigerant and oil for each refrigeration system. Replace losses of oil or refrigerant prior to end of correction period.
8. Charge system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.
9. Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

- B. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.

- C. Measure and record airflows.

- D. Verify proper operation of capacity control device.

3.6 ADJUSTING

- A. Adjust initial temperature set points.

- B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.7 CLEANING

- A. After completing installation, clean furnaces internally according to manufacturer's written instructions.
- B. Install new filters in each furnace.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain furnaces and heat pumps.

END OF SECTION 23 54 00

SECTION 23 72 00 – ENERGY RECOVERY VENTILATION UNITS

PART 1 - GENERAL

- 1.1 The fresh air ventilation system(s) shall utilize the RenewAire EV450IN total heat exchanger and energy recovery ventilation. The unit shall be selected in accordance with the building ventilation requirements.
- 1.2 The ventilation equipment shall be Energy Recovery Ventilator (ERV) as manufactured by RenewAire or Greenheck as an approved equivalent.
- 1.3 Quality Assurance
 - A. The energy recovery core shall be certified by ARI under it's standard 1060 for Energy Recovery Ventilators. Products not currently ARI certified will not be accepted.
 - B. Unit shall be listed under UL 1812, Standard for Ducted Air to Air Heat Exchangers. Due to ongoing product offerings and upgrades, some models and options are included in UL listing reports.
 - C. The energy recovery core shall meet NFPA 90A and 90B requirements for flame spread, not to exceed 25, and smoke generation, not to exceed 50, through an ongoing testing and verification program using UL standard 723.
- 1.4 Performance
 - A. Energy Recovery
 1. The energy recovery core shall be capable of transferring both sensible and latent energy between air streams. Latent energy transfer shall be accomplished through molecular transport by hydroscopic resin.
 - B. Passive Frost Control
 1. The energy recovery core shall perform without the occurrence of condensation of frosting under normal operating conditions (defined as outside temperature above -10F and inside relative humidity below 40%). Occasional extreme conditions shall not affect the usual function of performance of the energy recovery core.
 - C. Positive Air Stream Separation
 1. Exhaust and fresh airstreams shall at all times travel in separate passages, and airstreams shall not mix. The exhaust air transfer ratio (EATR) shall be ARI-1060 certified as 0% at balanced pressure.

D. Laminar Flow

1. Airflow through the energy recovery core shall be laminar, avoiding deposition of particulates on the interior of the exchange plate material.

1.5 Delivery, Storage and Handling

- A. Unit shall be stored and handled according to the manufacturer's recommendations.
- B. The unit will be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

PART 2 - WARRANTY

- A. The RenewAire core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase. Balance of unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of two years from the date of installation.

PART 3 - CONSTRUCTION

- 3.1 The energy recovery core shall be of static plate, cross-flow construction, with no moving parts.
- 3.2 The unit shall be capable of operating in winter and summer conditions without generating condensate. No condensate pan or drain shall be required.
- 3.3 The unit cabinet shall be constructed of galvanized, 20 gauge steel, with lapped corners.
- 3.4 The unit shall have single point power connection.
- 3.5 Flange components shall be provided suitable for connection of ductwork.
- 3.6 The exhaust and fresh air streams shall both be protected by MERV 8 rated, 2 inch pleated, disposable filters positioned before the ERV core.
- 3.7 Provide ECM controlled motors allowing either two preset speeds or variable speed operation with a 0-10 volt DC control signal. Electrical
- 3.8 The units will require a 208-230Volt, 1 Phase, 60Hz power supply.

PART 4 - CONTROL:

4.1 The ERU shall be controlled by digital time and be interlocked with MD-3 and MD-4.

PART 5 - DUCTWORK

5.1 The installer shall supply, install, test and commission all interconnecting ductwork.

A. Ductwork sizing, layout, fittings, etc shall be in strict accordance with the design requirements.

END OF SECTION 23 72 00

SECTION 23 74 00 – MAKE-UP AIR UNITS

1. GENERAL

1.1 SECTION INCLUDES

- A. Make-up Air Units.

1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. References.
- B. Submittals. Refer to 01 33 00 Submittals specification for required submittals.
- C. Product Data: For each type or model, include the following:
 - 1. Complete fan performance curves for Supply Air, with system operating conditions indicated, as tested in an AMCA Certified Chamber.
 - 2. Sound performance data for Supply Air, as tested in an AMCA Certified chamber.
 - 3. Motor ratings, electrical characteristics and motor and fan accessories.
 - 4. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
 - 5. Estimated gross weight of each installed unit.
 - 6. Installation, Operating and Maintenance manual (IOM) for each model.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain Packaged Make-Up Air Unit with Integral Heating with all appurtenant components or accessories from a single manufacturer.
- B. Product Options: Drawings must indicate size, profiles and dimensional requirements of Make-Up Air Units and are to be based on the specific system indicated.
- C. Certifications:
 - 1. Entire unit shall be ETL Certified per ANSI Z83.4 or ANSI Z83.18 and bear an ETL mark.

1.4 COORDINATION

- A. Coordinate size and location of all building penetrations required for installation of each unit and associated ducting, plumbing and electrical systems.
- B. Coordinate sequencing of construction of associated plumbing, HVAC, and electrical supply.

2. PRODUCTS

2.1 MAKE-UP AIR UNITS

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Captive-Aire Systems.
 - b. Greenheck
 - c. EconAir
- B. Manufactured Units:
1. Units with Integral Heating shall be fully assembled at the factory and consist of an insulated metal cabinet, a curb assembly, an outdoor air intake weatherhood with aluminum mesh, a motorized intake damper, supply air blower assembly, electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.
- C. Cabinet:
1. Materials: Formed, single wall metal cabinet with fiberglass duct liner insulation, fabricated to permit access to internal components for maintenance.
 - a. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvanized steel. Base rail is 12 gauge, galvanized (G90) steel.
 - b. Internal Assemblies: 24 gauge galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.
 2. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
 - a. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
 - 1) Thickness: 1 inch (25 mm)
 - 2) Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
 - 3) Location and application: Floor of each unit shall be insulated with fiberglass insulation. Full interior coverage from "Heating on".
 - 4) Access panels: Unit shall be equipped with insulated removable access panels to provide easy access to all major components. Access panels shall be fabricated of 18 gauge steel. Removable access panels shall incorporate a formed drip edge.
 - 5) Supply Air blower assembly options:
 - a) Forward curve blower: Blower assembly consists of an electric motor and a belt driven, double width, and double inlet forward curve blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on minimum 1.125 inch thick neoprene vibration isolators.
 3. Control center / connections:
 - a. Unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.

4. Motorized Inlet Air Dampers: to be of low leakage type and shall be factory installed.
5. Sensors are considered to be part of various optional operational modes or device controllers and are to be factory supplied and installed as specified by the A/E.
6. Curb Assembly: A curb assembly shall be made of galvanized steel provided by the factory for field assembly and installation as part of this division. The curb shall include a duct adapter for supply air. The installing contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly.

D. Blower:

1. Blower section construction, Supply Air: Belt drive motor and blower shall be assembled onto a minimum 14 gauge galvanized steel platform and must have neoprene vibration isolation devices, minimum of 1-1/8 inches thick.
2. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
3. Centrifugal blower housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.
4. Forward curved blower (fan) wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow. Mechanically attached to shaft with set screws.
5. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

E. Motors:

1. General: Blower motors greater than 3/4 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPart minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase, and enclosure.
2. Motors shall be 60 cycle, 1 phase, 230 volt.

F. Supply-Air Refrigerant Coils (Per Add Alternate 003):

1. Comply with AHRI 410.
2. Fabricate coils section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils are not to act as structural component of unit.
4. Tubes: Copper
5. Fins:
 - a. Material: Aluminum or Copper
 - b. Fin Spacing: Maximum 12 per inch
6. Fin and Tube Joints: Mechanical bond.
7. Headers: Seamless-copper headers with brazed connections
8. Frames: Galvanized steel
9. Ratings: Designed, tested, and rated in accordance with ASHRAE 33 and AHRI 410.
 - a. Working Pressure: Minimum 300 psig

G. Condensate Drain Pans:

1. Location: Each refrigerant coil
2. Construction:

- a. Single-wall, galvanized-steel sheet.
- b. Size: Large enough to collect condensate from cooling coils, including coil piping connections, coil headers, and return bends.

H. Controls

1. The unit shall be provided from the factory with:
 - a. 24VAC Transformer
 - b. Terminal Strip
 - c. Supply Fan VFD
 - d. Factory mounted and wired outdoor air inlet damper with actuator
 - e. Phase Monitor
2. Microprocessor Controller
 - a. The microprocessor control shall be factory programmed, mounted, wired and tested. Controller shall have a lighted LCD display and keypad for changing set points and monitoring unit operation. The controller shall be equipped with the following sensors:
 - 1) Outdoor air temperature sensor
 - 2) Supply discharge temperature sensor
3. Unit Start Command
 - a. A contact closure or jumper wire must be field wired between terminals R and G to enable the unit. When terminal G is energized the unit shall operate as described below. When terminal G is de-energized the unit is disabled.
4. Internal Time Clock (Schedule)
 - a. The microprocessor controller is equipped with an internal 7-day programmable time clock, allowing the user to add up to seven different occupancy schedules. The user may also add up to 15 holidays for additional energy savings.
5. Occupied/Unoccupied Modes
 - a. The microprocessor controller offers the following modes for determining occupancy:
 - 1) The internal time clock
 - 2) A remote contact (see wiring diagram for details)
 - b. The unit can be temporarily overridden to the occupied mode via a dry contact or the keypad display. After the override time has expired (1 hr, adj) the unit will return to the scheduled occupied/unoccupied mode.
6. Occupied Mode Unit Start-Up Sequence
 - a. Unit enable input must be closed (contact closure between R and G).
 - b. Initial delay, microprocessor controller initialization sequence.
 - c. Factory mounted and wired outdoor air inlet damper actuator is powered open.
 - d. Supply fan starts after 10 second (adj.) delay.

- e. Tempering operation begins (see modes below).
7. Supply Fan Sequence (Occupied)
- a. The unit has been provided with a factory mounted variable frequency drive (VFD). The variable frequency drive shall control the supply fan speed as indicated by the following sequence:
8. External 0-10 VDC Signal By Others:
- a. The supply fan speed is modulated by an external 0-10 VDC signal (field provided and wired) landed to terminals in the unit control center (see unit wiring diagram for details). The external signal shall control the VFD directly and the microprocessor controller shall have no control or monitoring of the supply fan speed.
9. Heating Control
- a. The heating will be locked out when the outside air is above the heating lockout set point (65 F adj.). When enabled heating will be controlled as follows: Heat pump will be enabled on a call for heating.
10. Cooling Control
- a. The cooling will be locked out when the outside air is below the cooling lockout set point (75 F adj.). When enabled cooling will be controlled as follows.
11. Packaged DX Cooling (Digital Scroll)
- a. The controller will modulate the digital scroll compressor to maintain the active supply temperature set point.
 - 1) The packaged DX system contains two stages of cooling. The lead circuit contains a digital scroll compressor capable of variable capacity. The second stage of cooling contains a standard scroll compressor that is enabled when additional cooling capacity is required.
12. Supply Temperature Set Point Control (Occupied)
- a. The active supply temperature set point shall be adjusted (field selectable):
 - 1) Locally at the controller.
 - 2) Reset based upon outside air temperature (field selectable)
13. Outside Air Reset Sequence
- a. The microprocessor controller monitors the outdoor air temperature and adjusts the desired supply temperature set point accordingly. For example, when the outdoor air is above 80 F, the controller will change the supply set point to 75 F. If the outdoor air is below 60 F, the controller will change the supply set point to 65F. If the outdoor air temperature is between 60 F and 80 F the supply set point is changed according to the outdoor air reset function. The outside air reset function is field adjustable locally at the controller.
14. Unoccupied Mode (Disabled)

- a. Supply Fan Is OFF
 - b. Factory mounted and wired outdoor air inlet damper actuator is de-energized and spring returns to the closed position.
15. Supply Air Low Limit
- a. If the supply air temperature drops below 35 F (adj.) for 300 seconds (adj.), the controller will de-energize the unit and generate an alarm.
16. Alarm Management
- a. The microprocessor controller will monitor the unit status for alarm conditions. Upon detecting an alarm, the controller will record the alarm description, time, date, available temperatures, and unit status for user review. A digital output is reserved for remote alarm indication.

3. EXECUTION

3.1 EXAMINATION

- A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
- B. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.3 CONNECTIONS

- A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.
 - 1. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.
 - 2. Duct installation and connection requirements are specified in Division 23 of this document.
 - 3. Electrical installation requirements are specified in Division 26 of this document.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

3.5 START-UP SERVICE

- A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Verify water source for compliance with manufacturer's requirements for flow and temperature. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hoods. Refer to Division 23.

END OF SECTION 23 74 00

SECTION 26 05 00 - ELECTRICAL GENERAL PROVISIONS

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 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.
- B. The Contract Drawings are shown in part diagrammatic intended to convey the scope of work, indicating the intended general arrangement of equipment, conduit, and outlets. Follow the drawings in laying out the work and verify spaces 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 Engineer before proceeding with the work.

1.3 QUALITY ASSURANCE

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 and shall be aligned, leveled, and adjusted for satisfactory operation.

1.4 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 codes, standards and regulations, etc.:
 - 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. Institute of Electrical and Electronic Engineers (IEEE).
 - 7. National Fire Protection Association (NFPA).
 - 8. Insulated Cable Engineers Association (ICEA).
 - 9. American Society for Testing and Materials (ASTM).
 - 10. Life Safety Code NFPA #101.
 - 11. Underwriters Laboratories, Inc. Standards (UL).
 - 12. Factory Mutual Engineering Corporation or other recognized National Laboratories.
 - 13. 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 MATERIALS AND EQUIPMENT

- A. Electrical materials and equipment for the entire project shall meet the requirements specified under the Supplementary Conditions Section of this specification.
- B. Equipment and fixtures shall be connected to provide circuit continuity in accordance with applicable Codes whether or not each piece of conductor, conduit, or protective device is shown between such items of equipment or fixtures and the point of circuit origin.
- C. The electrical work includes the installation or connection of certain materials and equipment furnished by others. Verify all connection details.
- D. All equipment over 50 pounds shall be provided with adequate lifting means.

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 ACCESS TO EQUIPMENT

- A. Starters, switches, receptacles, pull boxes, etc. shall be located to provide easy access for operation, repair and maintenance. If the devices listed above are concealed, access doors shall be provided.

3.2 SUBMITTALS

- A. Test Reports: Provide the tests as outlined in this specification and all other tests necessary to establish the adequacy, quality, safety, completed status, and suitable operation of each electrical system. Provide the Engineer with a complete schedule of all tests.
 - 1. Ground Rod Test: Immediately after installation, test driven grounds and counterpoises with a ground resistance direct-reading single-test megger, using the AC fall-of-potential method and two reference electrodes. Orient the ground to be tested and the two reference electrodes in a straight line spaced 50 feet apart. Drive the reference electrodes five feet deep. Disconnect the ground rod to be tested from other ground systems at the time of testing. The ground resistance for the electrical service must be 15 Ohms or less. Submit the results, date of test, and soil conditions to the Engineer in writing immediately after testing.
 - 2. Final Tests: Start final tests after complete preliminary tests have been made which indicate adequacy, quality, completion, and satisfactory operation of all electrical systems. Included in these tests are the following:
 - a. Completion of the form "Electrical Test Report" (attached to the end of this specification section) in sufficient quantity to provide the indicated information for each panelboard and switchboard in the project.
 - b. Completion of the form "Motor Test Report" (attached to the end of this specification section) in sufficient quantity to provide the indicated information for all three phase motors.

3. The Contractor shall submit the above completed reports to the Engineer, noting all deviations from the requirements listed below:
 - a. Plus or minus five percent variation between nominal system voltage and no load voltage, or plus or minus five percent variation between no load and full load voltage.
 - b. Plus five-percent variation between rated and actual motor current.
 - c. Plus or minus ten percent variation between average phase current and measured individual phase current. The Contractor shall balance phase currents of all distribution equipment within the tolerances specified.
 - d. Insulation resistance between conductors and ground of not less than 1,000,000 Ohms.
 4. Final Corrections: Correct promptly any failure or defects revealed by these tests as determined by the Engineer. Reconduct tests on corrected items as directed by the Engineer.
- B. Operation and Maintenance Manuals: Operation and Maintenance Manuals shall be provided according to Division 1 requirements. In general, during the time of the contract, and before substantial completion of the electrical installation, submit to the Engineer the number of copies described in the Division 1 specifications and the General and Supplemental Conditions copies of descriptive literature, maintenance recommendations (from the equipment manufacturer), data on initial operation, wiring diagrams, performance curves, engineering data and tests, operating procedures, routine maintenance procedures, and parts lists for each item of electrical equipment installed under this contract and submit all manufacturer's guarantees and warranties.
- C. Shop Drawings: 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.
1. 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 item's specific use, either by a particular type number referenced on the drawings or in the specifications, 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.
 2. 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 aesthetic reasons if felt necessary or desirable. In the event the proposed substitutions are rejected, the Contractor shall furnish the specified item.
- D. A Short Circuit study shall be provided by the contractor for this project. The study shall include maximum short circuit calculations and settings for all protective devices with adjustable set points. The study shall be based on the specific devices installed and include all **new equipment** (but not be limited to) the following:
1. Service Entrance Equipment.
 - a. All overcurrent protective devices installed in service entrance panels/switchboards.
 2. Feeder Circuits.

- a. All three (3) phase feeder circuit overcurrent protective devices.
 - 3. Branch Circuits.
 - a. All three (3) phase branch circuit overcurrent protective devices. installed with a rating equal to or greater than 30 amps.
 - b. All motor circuit overcurrent protective devices for motors with a rating equal to or greater than 10 horse power.
 - 4. Motor Control Centers
 - a. All motor circuit overcurrent protective devices for motors with a rating equal to or greater than 10 horse power.
 - 5. Format
 - a. The preliminary study should be submitted to the Owner's Representative no later than six (6) weeks after overcurrent protective device shop drawings have been reviewed.
 - b. The study shall be reviewed and updated to reflect any changes within one week of the final electrical walk through for project.
 - c. The low voltage study shall include the stamp or seal and signature of the preparing engineer, and shall be reviewed by the Engineer of Record.
 - d. A complete set of manufacturers' descriptive literature and detailed instructions for adjusting overcurrent protective devices shall be provided to the Owner's Representative within six (6) weeks after overcurrent protective device shop drawings have been approved.
 - e. The low voltage study shall be provided using the SKM Systems Analysis, Inc SKM Power Tools Electrical Engineering Software (PTW 32).
 - f. Prior to project completion, the low voltage study shall be provided to the Owner's Representative in both hard copy and on computer disk. The hard copy shall include time current curves (for phase and ground fault settings) for each panel and the corresponding TCC report clearly showing each device set point. The computer disk shall include the complete file including all library devices (use the SKM "Project - Backup" command).
- E. A low voltage Arc Flash Hazard Analysis shall be provided by the contractor for this project. The analysis shall be based on the specific equipment installed, and shall be updated to include project "as built" documentation. Where the arc flash hazard/risk category is equal to or greater than level 3, the overcurrent protective device coordination study shall be reviewed and recommendations shall be provided to reduce the hazard/risk level. The analysis shall be based on the specific devices installed and include all **new equipment** (but not be limited to) the following:
- 1. Service Entrance Equipment.
 - a. All overcurrent protective devices installed in service entrance panels/switchboards.
 - 2. Feeder Circuits.
 - a. All three (3) phase feeder circuit overcurrent protective devices.
 - 3. Branch Circuits.

- a. All three (3) phase branch circuit overcurrent protective devices installed with a rating equal to or greater than 30 amps.
 - b. All motor circuit overcurrent protective devices for motors with a rating equal to or greater than 10 horse power.
4. Motor Control Centers.
- a. All motor circuit overcurrent protective devices for motors with a rating equal to or greater than 10 horse power.
5. The project shall include printed waterproof labels for equipment that lists the specific arc flash hazard/risk category at each location.
6. Format
- a. A preliminary Arc Flash Hazard Analysis should be submitted to the Owner's Representative no later than six (6) weeks after the overcurrent protective device shop drawings have been reviewed.
 - b. The Arc Flash Hazard Analysis shall be reviewed and updated to reflect any changes and corrections to conductor length within one week of the final electrical walk through for the project.
 - c. The low voltage arc flash hazard analysis shall include the stamp or seal and signature of the preparing engineer, and shall be reviewed by the Engineer of Record.
 - d. Owner approved Arc Flash Hazard warning labels shall be furnished and installed prior to project completion.
 - e. The low voltage arc flash hazard analysis shall be provided using the SKM Systems Analysis, Inc SKM Power Tools Electrical Engineering Software (PTW 32).
 - f. Prior to project completion, the low voltage arc flash hazard analysis shall be provided to the Owner's Representative in both hard copy and on computer disk. The hard copy shall clearly show each device set point. The computer disk shall include the complete coordination file including all device curves (use the SKM "Project - Backup" command).

3.3 EXISTING UTILITIES

- A. The Contractor shall verify the location of all existing utilities with the Owner and Utility providers prior to commencing excavation work. In addition, the contractor is responsible for locating and maintaining all existing utilities without damage. Fully coordinate all new underground utility work with existing utilities on the site. 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 utility provider. Accuracy of this information is not assured.

3.4 ELECTRICAL SERVICE

- A. The Contractor shall provide all material and pay all fees required by the local utility provider for the connection of the new electrical service as shown on the plans. The Contractor shall also meet all equipment requirements of the local utility provider. The Contractor shall provide all necessary materials for construction of the temporary electrical service and shall coordinate all details with the local utility provider.

3.5 SMOKE AND SMOKE/FIRE DAMPERS

Provide all necessary duct detectors for smoke and smoke/fire dampers. In addition, provide all necessary connections, including power supply circuits (fed from the nearest panelboard, emergency if available, of the appropriate voltage unless indicated otherwise on the drawings) to smoke dampers and smoke/fire dampers so that upon fire alarm conditions or integral smoke detector activation, the dampers close. Coordinate damper and control locations with the mechanical and controls contractors. Refer to the mechanical drawings for damper schedule and locations.

3.6 ELECTRICAL-MECHANICAL EXTENT OF WORK

- A. The responsibility of work specified under Divisions 22, 23 and 26 is clarified under, Sections 22 05 00 and 23 05 00. Said Sections are incorporated herein by reference.

3.7 ELECTRICAL PRODUCT COORDINATION

- A. Refer to Division 2 through Division 32 and the electrical drawings for the power characteristics required and available for the operation of each power-consuming item of equipment. Coordinate purchases to ensure uniform interface with every item requiring electrical power.

3.8 CUTTING AND PATCHING

- A. The Electrical Contractor shall be responsible for all cutting and patching of holes in building construction which are required for the passage of electrical work. Cutting and patching shall conform to the requirements of 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.

3.9 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.

3.10 EXCAVATION AND BACKFILLING

- A. Contractor shall perform all excavation and backfilling necessary to install the required electrical work. Coordinate the work with other excavating and backfilling work in the same area. Except as indicated otherwise, comply with the applicable sections in Division 31 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.
- B. 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 Contractor.

3.11 CONDUITS AND SUPPORT, GENERALLY

- A. Conduits, except electrical conduits run in floor construction, shall be run parallel with or perpendicular to lines of the building unless otherwise noted on the drawings. Electrical conduits shall not be hung on hangers with any other service, 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.

3.12 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.

3.13 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.

3.14 ELECTRICAL DEMOLITION

- A. Refer to Division 01 Sections for general demolition requirements and procedures.
- B. Refer to the drawings for additional demolition requirements.
- C. Disconnect, demolish, and remove electrical systems, equipment and components specified under Divisions 26 & 28 and as indicated on the drawings.
 - 1. 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 circuiting.
 - 2. Coordinate all phasing and related electrical system outages with the Owner and all other disciplines.
 - 3. 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.

3.15 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, will be 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 ceiling, walls, and 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.
- B. Furnish and install, without additional expense to the Owner, all offsets, fittings and similar items necessary in order to accomplish the requirements of coordination.
- C. Before any sleeves or inserts are set, or any electrical equipment or foundations are installed, prepare and submit for approval composite coordination drawings for all equipment rooms, and other areas in which work of two or more trades or subcontractors is to be installed and in which the probability of interference exists. Drawings shall show the work of all trades covered, shall be drawn to a scale not smaller than 1/2" = 1'-0", and shall show clearly in both plan and elevation that all work can be installed without interference.
- D. Any work installed prior to approval of coordination drawings shall be at the Contractor's risk. Subsequent relocations required to avoid interference's shall be made without additional expense to the Owner.

3.16 SINGULAR NUMBER

- A. Where any device or part of equipment is herein referred to in the singular number (such as "the switch"), such reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

3.17 WARRANTY

- A. Refer to the General Conditions section of this Specification for warranty requirements and information.

3.18 CLOSE OUT AND OPERATION INSTRUCTIONS

- A. 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.
- B. 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.
- C. 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.

SUBSTITUTIONS

- D. All proposals shall be based on providing and installing the materials or items of equipment which are hereinafter specified by name and/or manufacturer. Substitutions, for materials or items of equipment specified, will not be allowed, unless approved by Engineer prior to (14 days before) bid date.
- E. Refer to Instructions to Bidders for complete requirements for substitutions.

3.19 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.

END OF SECTION 26 05 00

MOTOR TEST REPORT

DATE: _____

SHEET NO. _____ OF _____

PROJECT NAME: _____

PROJECT NUMBER: _____

DESIGNATION						
LOCATION						
HORSEPOWER						
NEMA STARTER SIZE						
MAXIMUM HEATER AMPS						
MEASURED CONDITIONS	PHASE			PHASE		
	A	B	C	A	B	C
ACTUAL MOTOR CURRENT						
NAMEPLATE MOTOR CURRENT						
NO LOAD VOLTAGE						
FULL LOAD VOLTAGE						

DESIGNATION						
LOCATION						
HORSEPOWER						
NEMA STARTER SIZE						
MAX HEATER AMPS						
MEASURED CONDITIONS	PHASE			PHASE		
	A	B	C	A	B	C
ACTUAL MOTOR CURRENT						
NAMEPLATE MOTOR CURRENT						
NO LOAD VOLTAGE						
FULL LOAD VOLTAGE						

ELECTRICAL TEST REPORT

DATE: _____

SHEET NO. _____ OF _____

PROJECT NAME: _____

PROJECT NUMBER: _____

SERVICE TRANSFORMER SIZE	
NO LOAD SERVICE VOLTAGE	
FULL LOAD SERVICE VOLTAGE	

DESIGNATION									
LOCATION									
MEASURED CONDITIONS	PHASE			PHASE			PHASE		
	A	B	C	A	B	C	A	B	C
NO LOAD FEEDER VOLTAGE									
OPERATING LOAD FEEDER VOLTAGE									
OPERATING LOAD FEEDER CURRENT									

DESIGNATION									
LOCATION									
MEASURED CONDITIONS	PHASE			PHASE			PHASE		
	A	B	C	A	B	C	A	B	C
NO LOAD FEEDER VOLTAGE									
OPERATING LOAD FEEDER VOLTAGE									
OPERATING LOAD FEEDER CURRENT									

SECTION 26 05 01- BASIC MATERIALS AND METHODS

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 work of this Section.

1.2 DESCRIPTION OF WORK

- A. The extent of Basic Materials and Methods is indicated by the drawings and specifications. Basic materials are defined but not limited to cable and conduit seals, outlet boxes, pull boxes, conduit fittings, safety switches, and fuses.

1.3 QUALITY ASSURANCE

- A. **Manufacturers:** 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.
- B. **Installer:** 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 all applicable sections of standards, codes and specifications promulgated by organizations listed below.
 - 1. Occupational Safety and Health Standard, National Consensus Standards and Established Federal Standards
 - 2. National Electrical Code (NEC)
 - 3. National Electric Manufacturer's Association (NEMA)
 - 4. American Society for Testing of Materials (ASTM)
 - 5. Underwriters Laboratories, Inc. Standards (UL)
 - 6. Factory Mutual Engineering Corporation or other Recognized National Laboratories

1.5 SUBMITTALS

- A. **Shop drawings:** Prepare a set of shop drawings showing manufacturers product data for all component parts specified in this Section.

2. PRODUCTS

- 2.1 **Equipment and Materials Furnished by Others:** Certain materials and equipment for this project will be furnished under other divisions. These materials and equipment, which are shown or noted on the plans, will be installed and/or connected under this Division. It shall be incumbent upon this Contractor to become familiar with all of the materials and equipment that will be furnished under other Divisions, but which will be installed and/or connected under this Division.

2.2 Cable and Conduit Seals: 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.

- A. 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.
- B. Accessory hardware shall be provided as required on oversized openings.
- C. Follow manufacturers instructions in selecting the type of seals and accessories. Also follow the manufacturers instructions on installation of the cable and conduit seals. Equal quality equipment by OZ Gedney and 3M shall be acceptable.

2.3 Outlet Boxes, Pull Boxes and Conduit Fittings: Furnish and install outlet boxes, pull boxes, and conduit fittings as described below. Catalog numbers shown are Appleton Electric Company; Steel City, O.Z. Gedney, and Raco, are equally acceptable.

A. OUTLET BOXES

- | | | |
|----|---|--|
| 1. | Lighting Boxes (concealed) | No. 40-3/4 |
| 2. | Lighting Boxes (concrete) | OCR Series |
| 3. | Lighting Boxes (exposed) | 4S-3/4 or 40-3/4 |
| 4. | 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) |
| 5. | Weatherproof type Switch and Receptacle Boxes (Exposed) | FS Series w/FS cover and neoprene gasket. |
| 6. | Weatherproof type Telecommunications Boxes (exposed) | FD Series w/FD cover and neoprene gasket. |
| 7. | Switch and Receptacle (exposed) | 4S-3/4 with 8360 or 8370 series raised surface cover. |

8. Telecommunications Boxes

- a. At minimum, the typical communications backbox shall be 4-11/16-inch square by 2-1/8- inch deep with 1-1/4-inch knockouts and a 4-11/16-inch square mud ring for one (1) device (single-gang) unless noted otherwise.
- b. For flush mounted boxes, Manufacturer shall be:
 - 1) RACO/Hubbell Electrical Products – 4-11/16-inch Square Box, 2-1/8-inch Deep, 1-1/4-inch Side Knockouts. (P/N RACO259) with 4-11/16-inch square mud ring for one (1) device (verify appropriate Mud-Ring depth).
 - 2) Randl Industries, Inc. – 5-square Telecommunications Outlet Box (P/N T55017) with appropriate single gang mud ring.
 - 3) Or approved equivalent.
- c. For outlets in CMU wall, submit appropriate backbox for application.
- d. For outlets above ceiling for applications such as Wireless Access Points
 - 1) RACO/Hubbell Single-gang Galvanized Steel Box (P/N 2DDB6)
 - 2) Or approved equivalent.

B. Extension and plaster rings shall be installed as required by the NEC.

C. Outlet boxes shall comply with the National Electrical Code in regard to the allowable fill.

2.4 PULL BOXES

A. Pull boxes shall be fabricated of code gauge galvanized sheet metal and shall be sized in accordance with the 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.

2.5 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:
- B. NEMA 1 general purpose enclosures unless otherwise noted for all interior applications;
- C. NEMA 3R rainproof enclosures unless otherwise noted for all exterior applications;
- D. Fully rated neutral assemblies;
- E. Equipment grounding kits;
- F. Metal nameplates, front cover mounted that contain a permanent record of switch type, catalog number and H.P. ratings with both standard and time delay fuses;
- G. Handle that is padlockable in "OFF" position;

- H. Non-teasible, positive quick-make, quick-break mechanism;
- I. UL approval and shall bear the UL label;
- J. All fusible switches shall have Class R Fuse rejection clips.
- K. Safety switches, as manufactured by the following, will be equally acceptable, but all safety switches furnished by this Contractor shall be the product of one manufacturer:
 - 1. Square D Company
 - 2. General Electric
 - 3. Cutler Hammer
 - 4. Siemens

2.6 FUSES

- A. Fuses shall be furnished and installed in each fused switch, and shall be rated as shown on the drawings.
- B. Provide fuses according to the following and in accordance with recommendations of manufacturers whose equipment is being protected:
 - 1. Provide UL Class L current limiting time-delay fuses rated 600-volts, 60 Hz, 601 to 6000 amps, with 200,000A RMS symmetrical interrupting current rating for protecting transformers, motors and circuit breakers. (Similar to Buss Low-Peak fuses.)
 - 2. Provide UL Class L current limiting fast-acting fuses rated 600-volts, 60 Hz, 601 to 6000 amps, with 200,000A RMS symmetrical interrupting current rating for protecting service entrances and main feeder circuit breakers. (Similar to Buss Limitron fuses.)
 - 3. Provide UL Class RK1 current limiting, dual-element, time-delay fuses rated 600-volts, 60 Hz, 1/10 to 600 amps, with 200,000A RMS symmetrical interrupting current rating for protecting motors and circuit breakers. (Similar to Buss Low-Peak fuses.)
 - 4. Provide UL Class RK1 current-limiting fuses rated 250-volts, 60 Hz, 1/10 to 600 amps, with 200,000A RMS symmetrical interrupting current for protecting motors and circuit breakers. (Similar to Buss Low-Peak fuses.)
 - 5. Provide UL Class J current-limiting fuses rated 600-volts, 60 Hz, 1 to 600 amps, with 200,000A RMS symmetrical interrupting current rating for protecting circuits with no heavy inrush current where reduced dimension devices are required.
 - 6. Provide UL Class H fuses rated 600-volts, 60 Hz, 1/10 to 600 amps, with 10,000A RMS symmetrical interrupting current rating for protecting general purpose light duty feeders.
 - 7. Provide UL Class T fuses rated 600-volts, 60 Hz, 1 to 1,200 amps, with 200,000A RMS symmetrical interrupting current rating for protection of non-motor loads where reduced dimension devices are required.
- C. 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.

3. EXECUTION

3.1 PRODUCT INSTALLATION, GENERAL

- A. Except where more stringent requirements are indicated, comply with product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing.

3.2 MOUNTING HEIGHTS

- A. Mounting heights to the center of the box 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.
- B. Flush tumbler switches and lighting controls 46"
- C. Switches in concrete block 46"
- D. Switches over wainscot 6" above 48" wainscot
- E. Convenience outlets 18" mounted vertically with ground
prong slot at bottom
- F. Safety switches 54"
- G. Motor controllers 54"
- H. Panelboards to top 72"
- I. Telecommunications outlets 18"
- J. Telecommunications outlets 54" for non-ADA type
(pay and wall type) 44" for ADA type
- K. Clock outlets 8' ceiling 84"
9' ceiling 96"
- L. Receptacles above counters 8" above counters mounted
vertically
- M. Convenience outlets in 48"
mechanical, electrical, telecommunications, janitor
and elevator machine rooms
- N. Exterior W.P. convenience 24" above grade mounted
outlets
- O. Fire alarm pull station 46"
- P. Fire alarm horn, speaker, bell chime 84"
And/or strobe
- Q. Intercom System Pushbutton 46"
Stations
- R. Card Readers 46"

- S. Contractor shall check all equipment layouts and verify exact mounting heights.

3.3 CUTTING AND PATCHING FLOORS, WALLS OR CEILINGS

- A. Cutting, patching, repairing, and finishing of carpentry work, metal work, or concrete work, etc., which may be required for this work shall be done by craftsmen skilled in their respective trades. When cutting is required, it shall be done in such a manner as not to weaken walls, partitions, or floors. Holes required to be cut in floors must be drilled without breaking out around the holes. Cutting, patching, and painting shall conform to the requirements of the General Conditions section of this Specification.
- B. Cutting of structural framing, walls, floors, decks, or other members intended to withstand stress is not permitted.
- C. Sleeves through floors or walls shall be black iron pipe and shall be flush with finished faces of floors, walls or ceilings. Sleeves shall be sized to accommodate raceways indicated.
- D. Use care in piercing water proofing. After the part piercing the waterproofing has been set in place, seal openings, and make absolutely watertight.

3.4 SLEEVES

- A. Sleeves shall be used to accommodate conduit or tubing where conduit or tubing pass through newly poured concrete walls or slabs.
- B. All sleeves through floors and walls shall be black iron pipe, flush with walls or finished floors; and of sizes to accommodate the raceways shown. 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 thruwall seals, similar to Type "FSK" or "WSK" as manufactured by O.Z. Electric Manufacturing Co.

3.5 INSTALLATION METHODS

- A. Conductors shall be installed in concealed raceways except as shown otherwise on the drawings or specified to be otherwise in these specifications. Exposed conduits and wires shall be installed parallel or perpendicular to 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. Conduits and wires installed above ceilings shall be considered exposed.
- B. Electrical conduits shall not be hung on hangers with any other service foreign to the electrical systems, nor shall they be attached to other foreign services.
- C. The lighting and power branch circuit conductors shall be installed in separate raceway systems unless specifically shown or noted otherwise.
- D. Equipment Bases. Provide concrete equipment bases for all floor mounted equipment furnished under this contract. Concrete bases shall be 3-1/2"-inches high unless noted otherwise and shall extend 3-inches beyond all sides of the unit. Trowel all edges at a 45 degree angle. This work shall be done in accordance with Division 3 of the specifications by the

Division 26 Contractor. Bases shall be provided for switchboards, motor control centers, transformers and all other floor mounted equipment.

- E. 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.

3.6 WIRING - NUMBER OF WIRES REQUIRED

- A. The number of wires for lighting and receptacle branch circuits is shown on the drawings. The number of wires in any circuit is determined in accordance with the National Electrical Code, and wiring is 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.

3.7 PROTECTION FROM WEATHER

- A. Raceway stub ups shall be capped or otherwise protected from moisture and debris until such time that the conductors are pulled. Conductors shall not be installed in raceways until the building is protected from the weather, all concrete and plastering is completed, and raceways in which moisture has collected have been swabbed or blown out.

3.8 ELECTRICAL ROOM COORDINATION

- A. Where a number of electrical panels and/or related electrical items are shown, the Electrical Contractor shall coordinate the physical sizes with his equipment suppliers to ensure that there is adequate space for the items shown to be installed in those areas and that all Code required clearances are maintained.
- B. The Contractor shall rearrange the equipment layout to achieve full use of the available space prior to installing conduit stub ups. Where a conflict or rearrangement exists, the Contractor shall submit a proposed revised layout of the area to the Engineer.

3.9 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.
- D. Namesplates shall also be provided listing calculated SCCR at the main service distribution equipment and elevator controllers in accordance with NEC requirements.

3.10 RACEWAY SUPPORTS

- A. Raceways shall be securely supported and fastened in place with pipe straps, wall brackets, caddy clips, hangers or trapeze hangers at intervals specified in Section 26 05 33 "RACEWAYS" or:
 - 1. As shown on the drawings.
 - 2. As may be required by special adverse field conditions.
- B. Spring tension clamps on building steel work may be used only by special permission.
- C. Fastenings shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws or welded threaded studs on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine wood screws. Threaded C-clamps shall not be used. Raceways or pipe straps shall not be welded to steel structures. Holes cut in reinforced concrete beams or in concrete joists shall avoid cutting the main reinforcing bars. Holes not used shall be filled. In partitions of light steel construction, sheet-metal screws may be used, and bar hangers may be attached with saddle ties of not less than No. 16 AWG double strand zinc-coated steel wire. No raceway shall be attached to the suspended ceiling construction. Conduits shall be fastened to all sheet-metal boxes and cabinets with two locknuts and insulating bushings.

3.11 BOX SUPPORTS

- A. Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel work. Plastic expansion shields shall not be used. Threaded studs driven in by powder charge and provided with lockwashers and nuts may be used in lieu of wood screws, expansion shields, or machine screws. In open overhead spaces, cast metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Raceways shall be supported with an approved type fastener not more than 24-inches from the box. Penetration into reinforced concrete beams and into reinforced-concrete joists shall avoid cutting any main reinforcing steel.

3.12 LIGHTING FIXTURE SUPPORTS

- A. Lighting fixtures shall be supported as follows and in accordance with all applicable Codes and Regulations:
 - 1. By fixture studs or other devices securely attached to outlet box, or;
 - 2. By special hangers designed and intended for use as lighting fixture supports, or;
 - 3. By a special clip or device attached to the ceiling system grid designed to secure the lighting fixture in place or;
 - 4. By other methods and devices designed and intended for use as lighting fixture support, or;
 - 5. As shown on the drawings.
 - 6. 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. 9 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.

7. 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.
 - B. The lighting fixture support system detail shall be submitted with and be a part of the lighting fixture shop drawing submittal.
 - C. Lighting fixtures shall not be supported from the leg of pre-cast pre-stressed concrete.

END OF SECTION 26 05 01

SECTION 26 05 19 - CONDUCTORS

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 work in this Section.
- B. This Section is a Division 26 "Basic Materials and Methods" section, and is part of each Division 26 section making reference to conductors.

1.2 Description of Work: Extent of electrical wire and electrical cable work is indicated by drawings and schedules. Types of wire, cable and connectors in this Section include the following:

- A. Conductors
- B. Power-limited circuit cable
- C. Service entrance cable

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the manufacture of electric wire and cable products of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: Qualified with at least 3 years of successful installation experience on projects with electrical wiring work similar to that required for this project.

1.4 REFERENCES

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wire, cable and connectors.
- B. UL Compliance: Comply with UL standards pertaining to wire cable and connectors.
- C. UL Labels: Provide electrical wires, cables and connectors which have been UL-listed and labeled.
- D. NEMA/ICEA Compliance: Comply with applicable portions of NEMA/Insulated Cable Engineers Association Standards pertaining to materials, construction and testing of wire and cable.
- E. ANSI/ASTM: Comply with applicable portions of ANSI/ASTM standards pertaining to construction of wire and cable.
- F. IEEE Compliance: Comply with applicable portions of IEEE standards pertaining to wire and cable.

G. NECA Compliance: Comply with NECA's "Standard of Installation."

1.5 SUBMITTALS

A. Submit manufacturer's data on electric wire and cable.

2. PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of wire, cable and connector):

A. WIRE AND CABLE:

1. Advance Wire and Cable, Inc.
2. Cerro Wire and Cable, Co.
3. Electrical Conductors, Inc.
4. General Cable Corp.
5. Hitemp Wires, Inc.
6. Rome Cable Corp.
7. Southwire Company
8. The Okonite Company
9. Encore Wire

B. CONNECTORS:

1. Amp, Inc.
2. Burndy Corp.
3. Eagle Electric Mfg. Co., Inc.
4. Gould, Inc.
5. Ideal Industries, Inc.
6. Josylyn Mfg. and Supply Co.
7. O-Z/Gedney Co.
8. Pyle National Co.
9. Thomas and Betts Co.

2.2 WIRE, CABLE, AND CONNECTORS

A. General: 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.

B. WIRE:

1. 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.
2. No wire shall be smaller than No. 12 AWG, except wiring for signal and pilot control circuits, and pre-manufactured fixture whips for light fixtures.
3. All wire No. 12 AWG shall be solid unless otherwise indicated within these specifications. All wire No. 10 AWG and larger shall be stranded.
4. All wiring installed in light poles or other areas subject to vibration shall be stranded.

5. 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).
6. All feeder and branch circuit wiring shall be color-coded as follows:

<u>PHASE</u>	<u>120/208 VOLT</u>	<u>277/480 VOLT</u>
A	Black	Brown
B	Red	Orange
C	Blue	Purple
Neutral	*White	*White
Ground	Green	Green

*Except as provided in paragraph 200.6 of the NEC.

C. ALUMINUM WIRE:

1. Aluminum conductors shall not be substituted for copper conductors.

D. CONNECTIONS

1. Wire connections shall be as follows unless otherwise indicated on the drawings.
 - a. Use preinsulated connectors 3M Company "Scotchlok," or Ideal Industries, Inc. "super nut," for splices and taps in conductors No. 10 AWG and smaller. All other twist-on connectors must be reviewed by the Architect prior to installation. Use this type of connector for factory-made splices in fixtures or equipment.
 - b. Pressure indent type connectors must be submitted to the Architect for review.
 - c. Tape all splices and joints with vinyl plastic tape manufactured by Minnesota Mining and Manufacturing Company. Use sufficient tape to secure insulation strength equal to that of the conductors joined.
 - d. Keep splices in underground junction boxes to an absolute minimum. Where splices are necessary, use resin pressure splices and resin splicing kits manufactured by the 3M Company, St. Paul, Minnesota, to totally encapsulate the splice. Arrange the splicing kit to minimize the effects of moisture.
 - e. Connect wire No. 6 AWG and larger to panels and apparatus by means of approved lugs or connectors.
 - f. Connect wire No. 10 AWG and larger to panels, motors and electrical apparatus using OZ (or equivalent) type XL set screw type lugs. Lugs shall accommodate full wire capacity for stranded conductors. All connections and connectors shall be solderless.
 - g. Connectors of the porcelain cup type with or without metal inserts shall not be used, including all splices in fixtures which are made in advance by the fixture manufacturer. Splices in wire No. 8 AWG and larger shall be made with approved solderless lugs. If any type of pressure indent type connector is proposed for use on any size conductor, it shall be specifically submitted for approval prior to use.

3. EXECUTION

3.1 INSTALLATION

- A. General: Install electric cables, wires and connectors as indicated in compliance with manufacturer's written instructions, applicable requirements of the NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface.
- C. Conductors shall be continuous from outlet to outlet and no splices shall be made except within outlet or junction boxes. Junction boxes may be utilized wherever required.
- D. Splicing: No splicing or joints will be permitted in either feeder or branch circuits except at outlet or accessible junction boxes.
- E. Wire shall not be installed in raceways until the concrete work and plastering is completed and all conduits in which moisture has collected have been swabbed out. Insulation resistance to ground shall not be less than that approved by NEC. Eliminate splices wherever possible.
- F. Use pulling compound or lubricant where necessary. Compound must not deteriorate conductor insulation.
- G. Prior to energization, check cable and wire for continuity of circuitry, and for short circuits. Correct malfunctions when detected.
- H. Bury a continuous, pre-printed, bright colored plastic ribbon cable marker with each underground cable, regardless of whether conductors are in conduit. Locate each directly over cables 12" below finished grade.
- I. Conductor Installation: Install all conductors in a single raceway at one time, insuring that conductors do not cross one another while being pulled into raceway. Leave sufficient cable at all fittings or boxes and prevent conductor kinks. Keep all conductors within the allowable tension and exceeding the minimum bending radius.
- J. Conductor Support: Provide conductor supports as required by the code and recommended by the cable manufacturer. Where required, provide cable supports in vertical conduits similar to OZ Type C.M.T., and provide the lower end of conduit with OZ Type KVF ventilators.
- K. Conductor Termination: Provide all power and control conductors, that terminate on equipment or terminal strips, with solderless lugs or fork and flanged tongue terminals. Provide T and B "sta-kon" tongue terminal. This type conductor termination is not required when the equipment is provided with solderless connectors.
- L. **Many circuits are shown on the drawings to be provided with dedicated neutral and ground conductors. Carefully review circuiting and the electrical abbreviations and symbols legend and provide the number of conductors indicated.**
- M. **Unless otherwise indicated provide dedicated neutral conductors for all branch circuits. Neutral conductors shall not be shared between circuits. Where the drawings indicate shared neutral conductors, for a multi-wire branch circuit, group the breakers together in accordance with NEC requirements.**

3.2 CONDUCTOR ARCPROOFING

- A. Cover two or more power feeder cables occurring in the same switchboard section, junction box or pull box (including pull boxes over switchboards) with arcproof and flameproof tape.
- B. Provide 3M Company "Scotch" No. 77 tape or Plymouth Rubber Co. Slipknot No. 30 tape, to provide an installation capable of withstanding a 200-amp arc for not less than 30 seconds.
- C. Apply tape in a single layer, one-half lapped, or as recommended by the manufacturer to conform to the above requirements. Apply with the coated side next to the cable and hold in place with a random wrap of 1/2 inch wide, pressure-sensitive, glass cloth electrical tape, 3M Company "Scotch" No. 69. Tape to be color coded as specified previously.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING SYSTEM

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 work of this Section.
- B. Division 26 "Basic Materials and Methods" sections apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of grounding work is indicated by the drawings and is specified herein.
- B. Applications of grounding work in this Section include the following:
 - 1. Underground Metal Piping
 - 2. Underground Metal Water Piping
 - 3. Metal Building Frames
 - 4. Ground Rods
 - 5. Separately Derived Systems
 - 6. Service Equipment
 - 7. Enclosures
 - 8. Equipment
- C. Requirements of this Section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings, of types and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, ground rods and plate electrodes, whose products have been of satisfactory use in similar service for not less than three years.
- B. Installer: Qualified with at least three (3) years experience on projects with electrical grounding work similar to that required for this project.

1.4 REFERENCES

- A. NEC Compliance: Comply with NEC requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL listed and labeled.
- B. UL Compliance: Comply with applicable requirements of UL Standard Nos. 467 and 869 pertaining to electrical grounding and bonding.
- C. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

- D. Utility: Grounding shall be done so as to comply with all applicable grounding requirements and rules of the serving utility.
- E. NECA Compliance: Comply with NECA's "Standard of Installation."

1.5 SUBMITTALS

- A. Product Data: Submit manufacturers data on grounding systems and accessories.
- B. Shop Drawings: Submit layout drawings of grounding systems and accessories including, but not limited to, ground wiring, copper braid and bus, and ground rods.

2. PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with the requirements, provide grounding products of one of the following:

- A. B-Line Systems
- B. Burndy Corporation
- C. Crouse Hinds
- D. Electrical Components Div.; Gould Inc.
- E. General Electric Supply Co.
- F. Ideal Industries, Inc.
- G. Thomas and Betts Corp.
- H. Western Electric Co.

2.2 Grounding Systems: Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including but not limited to cables/wires, connectors, terminals, ground rods/electrodes, bonding jumper braid, and additional accessories needed for a complete installation. Where more than one type unit meets indicated requirements, selection is installer's option. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE and established industry standards for applications indicated.

2.3 Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC requirements.

2.4 Bonding Jumper Braid: Provide copper braid tape, constructed of 30 gage bare copper wires and properly sized for indicated applications.

2.5 Flexible Jumper Strap: Provide flexible flat conductor, 480 strands of 30 gage bare copper wire; 3/4" wide, 9-1/2" long; 48,250 cmil. Protect braid with copper bolt hole ends with hole sized for 3/8" dia. bolts.

- 2.6 Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.
- 2.7 Ground Rods: Provide steel ground rods with copper welded exterior, 3/4" dia. x 10'.
- 2.8 Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, and bonding straps as recommended by accessories manufacturers for types of service indicated.

3. EXECUTION

3.1 GENERAL

- A. Inspection: Installer must examine areas and conditions under which electrical grounding connections are to be made and notify the Architect/Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- B. General: Install electrical ground systems where shown, in accordance with applicable portions of the NEC, with NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.
- C. Coordinate with other electrical work as necessary to interface installation of electrical grounding systems with other work.
- D. Grounding and bonding of electrical installations and specific requirements for systems, circuits and equipment required to be grounded shall be accomplished for temporary and permanent construction.
- E. Provide a separate green equipment ground conductor in all electrical raceways to effectively ground all fixtures, panels, receptacles, controls, motors, disconnect switches, exterior lighting standards and noncurrent carrying metal enclosures. The ground wires shall be connected to the building system ground. NEC Table 250-95 shall be used to size the ground conductor if the size is not shown on the drawings.
- F. To satisfy the "effective grounding" requirements of the NEC the path to ground from circuits, equipment, and conductor enclosures shall be permanent and continuous and shall have ample carrying capacity to conduct safely any currents liable to be imposed on it, and shall have impedance sufficiently low to limit the potential above ground and to facilitate the operation of the overcurrent devices in the circuit.
- G. Ground the service in accordance with provisions of the National Electrical Code and the contract drawings.
- H. In addition to the requirements for service entrance grounding listed above, provide a supplemental grounding electrode consisting of driven ground rods (three 10 foot x 3/4 inch copper-clad steel ground rods).
- I. Clean the contact surfaces of all ground connections.

- J. Where separately derived systems occur, ground the system to a grounding electrode acceptable to the code.
- K. Install metallic raceways mechanically and electrically secure at all joints and at all boxes, cabinets, fittings and equipment. At the point of electrical service entrance, bond all metallic raceways together, with a ground conductor, and connect to the system ground bus. Bond all boxes as specified for equipment.
- L. Receptacles: Permanently connect the ground terminal on each receptacle to the green ground conductor.
- M. Motors: Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted, solderless lug.
- N. Provide necessary ground connections to telephone service entrance equipment. Verify requirements with the local telephone company.

END OF SECTION 26 05 26

SECTION 26 05 33 - RACEWAYS

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 work of this Section.
- B. This Section is a Division 26 "Basic Materials and Methods" section, and is part of each Division 26 section making reference to electrical raceways specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of raceways is indicated by drawings and schedules.
- B. Types of raceways in this Section include the following:
 - 1. Electrical metallic tubing.
 - 2. Flexible metal conduit.
 - 3. Intermediate metal conduit.
 - 4. Liquid-tight flexible metal conduit.
 - 5. Rigid metal conduit.
 - 6. Rigid nonmetallic conduit.
 - 7. Surface metal raceways.

1.3 REFERENCES

- A. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
- B. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL-listed and labeled. Each length of raceway shall bear the Underwriters Laboratories label.
- C. NEC Compliance: Comply with NEC requirements which are applicable to the construction and installation of raceway systems.
- D. NECA Compliance: Comply with NECA's "Standard of Installation".

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of raceway required.

2. PRODUCTS

2.1 STEEL CONDUIT

- A. Steel Conduit: Rigid steel conduit, intermediate metal conduit and steel electrical metallic tubing shall be hot-dipped, galvanized or sheradized as manufactured by Youngstown Sheet and Tube Company, National Electric, General Electric, or equal.
- B. 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.
- C. Expansion Joints: Provide expansion fittings, O.Z. Type AX with bonding jumper for rigid conduit and O.Z. Type TX with bonding jumper for electrical metallic tubing. Where embedded raceways cross building expansion joints, provide combination deflection/expansion fittings, O.Z. Type AXDX, or equal.

2.2 RIGID NON-METALLIC (PVC) CONDUIT

- A. PVC (polyvinyl chloride) Conduit: Heavy wall rigid PVC conduit shall be composed of high impact PVC and shall conform to industry NEMA Standards and to Federal Specification WC-1094. Conduits shall be Carlon Schedule 40 type, or approved equal.

2.3 FLEXIBLE METAL CONDUIT

- A. Flexible metal conduit shall conform to UL1. It shall be formed from continuous length of spirally-wound, interlocked zinc-coated strip steel.
- B. **Pre-wired armored cabling, types AC or MC are not allowed.**

2.4 LIQUID-TIGHT, FLEXIBLE METAL CONDUIT

- A. Liquid-tight flexible metal conduit shall be constructed of a single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; and coated with an oil-resistant, liquid-tight thermoplastic jacket.

2.5 WIREWAYS

- A. General: Provide electrical wireways of types, grades, sizes, weights (wall thicknesses), and number of channels for each type service indicated. Provide complete assembly of wireways including, but not necessarily limited to couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, and other components and accessories as needed for a complete system. Where types and grades are not indicated, provide proper selection as determined by the Installer to fulfill wiring requirements and comply with applicable provisions of NEC for electrical raceways.
- B. Surface Metal Raceways: Provide surface metal raceways of sizes and channels indicated; in compliance with FS W-C-582. Construct of galvanized steel with snap-on covers, with 1/8" mounting screw knockouts in base approximately 8" o.c. Provide fittings indicated which match and mate with raceway. Finish with manufacturer's standard prime coating suitable for painting. Provide all necessary devices as shown on the drawings for a complete installation.
- C. Manufacturers: Subject to compliance with requirements, provide surface metal raceways of one of the following:
 1. B-Line Systems, Inc.

2. Midland-Ross Corporation
3. Power-Strut Division; Youngstown Sheet and Tube Company
4. Square D Company
5. Versa-Tech Corporation
6. Walker/Parkersburg Division; Textron, Inc.
7. Wiremold Company

3. EXECUTION

3.1 GENERAL

- A. Install electric raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of the NEC and NECA's "Standard of Installation" and complying with recognized industry practices.
- B. 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.
- C. Electrical metallic tubing shall not be embedded in concrete or installed in earth.
- D. Rigid heavy wall Schedule 40 PVC conduit shall be installed in earth and concrete only.
- E. Raceways in outside walls (excluding building perimeter) or in refrigerated areas shall be rigid steel conduit, or intermediate metal conduit.
- F. 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.
- G. Rigid galvanized steel conduit or galvanized intermediate metal conduit shall be used where conduit is exposed to weather.
- H. Conduits in hazardous locations shall conform to the National Electrical Code. Rigid galvanized steel conduit or intermediate metal conduit shall be used in hazardous locations. PVC conduit shall not be used in hazardous areas.
- I. Rigid metal, intermediate metal, electric metallic tubing or PVC conduit where allowed in other section 3.1 paragraphs shall be used for feeders and branch circuits.
- J. 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. "Daisy chaining" from fixture to fixture is not permitted. Provide flexible metal conduit for connections to motors, transformers, generators, and other equipment subject to vibration. Length of flexible conduit shall be a minimum of one foot for conduit diameters up to 1-1/2". A minimum of 3" of flexible conduit shall be added for every 1/2" increase in conduit diameter. Flexible metal conduit installation shall be kept to a minimum in connecting other electrical equipment items. Sealtight, flexible conduit shall be used where the flexible conduit may be subject to moist or humid atmosphere, corrosive atmosphere, subject to water spray and subject to dripping oil, grease or water. **Flexible metal conduits shall not be permitted for any other applications, unless specifically approved by the Owner**

- K. Conduits shall be 3/4" diameter, minimum. Raceway sizes shown on the drawing are based on type THHN/THWN conductors.
- L. Type Material: Except as noted otherwise all conduit shall be steel.

3.2 INSTALLATION

- A. All raceways shall be installed concealed except where shown or noted otherwise.
- B. Continuity: 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. Provide double locknut and bushing on terminals of metallic conduits.
- C. A nylon or polypropylene pull string shall be installed in all empty conduits to facilitate future installation of cabling.
- D. Provide accessible "seal-off" fittings for all raceways entering or leaving hazardous areas, entering or leaving refrigerated areas and as otherwise required by the National Electrical Code.
- E. Where conduits penetrate the roof seal, they shall be installed in curbs provided for mechanical equipment. When this is not possible, suitable pitch pockets, lead flashing, or approved fittings shall be provided. Details for special conduit installations shall be as shown on the drawings.
- F. Reinforced Concrete: No reinforcing steel shall be displaced to accommodate the installation of raceways and outlet boxes. Outlet boxes shall not be installed in beams or joists. In general, all embedded conduits shall be located in the physical center of the particular section of concrete. Unless otherwise indicated, raceways embedded in reinforced concrete shall conform to the following usual types of conditions. Particular attention is called to the fact that there are many extenuating conditions where the Contractor may be instructed in writing during the course of the project not to place embedded conduits in certain areas, generally due to the possibility of unsightly cracking or for structural reasons. This instruction shall not entitle the Contractor to extra compensation. Any condition not covered by the following usual conditions shall require special clarification.

<u>Location</u>	<u>Maximum Allowance</u>
-----------------	--------------------------

- | | | |
|----|-------------------------------|--|
| 1. | Columns | Displacement of 4 percent of plan area of column. |
| 2. | Floors and Walls | Displacement of 1/3 of thickness of concrete spaced not less than three diameters on center. |
| 3. | Beams and Joists | Displacement of 1/3 of least dimension, spaced not less than three diameters on center. |
| 4. | Sleeves thru Floors and Walls | 2" maximum pipe size, not less than three diameters on center. |

- G. Plain Concrete: Raceways shall not be placed in plain concrete, such as cement toppings on structural floors without special instructions.
- H. Furred Spaces: Raceways installed in furred spaces shall be installed in accordance with the requirements of the National Electrical Code. Do not anchor or strap conduits to the ceiling furring channels or attach to furred ceiling hanger wires. Raceways may be attached to the

suspension system (wire hangers) of drop ceilings if installed in such a manner that the ceiling panels may be removed without interference with the raceway, and the wire hangers are sized to carry the additional raceway load.

- I. Stub Ups: Extend conduit stubs at least one foot above slab or fill, before connection is made to electrical metallic tubing.
- J. Exterior Conduits: Install raceways a minimum of 42" below finished grade unless noted otherwise on the drawings.
- K. Provide marking of conduit and junction boxes to indicate which distribution system they are serving. The markings could be colored tape on conduit at or near junction boxes with different colored tapes indicating different distribution systems. Concealed junction boxes shall be legibly marked with a magic marker to indicate the panel and circuit number that junction box serves.
 - 1. The distribution systems shall be color coded as follows:
 - a. Fire Alarm - Red
 - b. 120/208 Volt - Green
 - c. 277/480 Volt - Orange
 - d. Telephone System - White
- L. Steel Conduit (galvanized rigid steel, IMC or EMT):
 - 1. Cutting: Cutting shall be done with hand or power hacksaws. All cut ends shall be reamed to remove burrs and sharp edges.
 - 2. All threaded joints shall be made up wrench-tight and all compression joints shall be made up mechanically secure and snug so as to make continuous current-carrying electrical contact.
 - 3. All metallic conduits buried or otherwise in contact with earth shall be painted using one heavy continuous coat of asphalt varnish after assembly of conduit and fittings.
 - 4. Expansion joints shall be installed in steel conduit systems in structures as follows (expansion joints are specified elsewhere in the specification):
 - a. Where conduit run crosses a building expansion joint.
 - b. In any conduit run exceeding 100 feet in length.
 - c. Where shown on the drawings.
- M. Threads: Clean all threads of rigid or intermediate metal conduit. Coat all male threads of all steel conduit installed in concrete with red or white lead immediately before being coupled together.
- N. Running Threads: Use "Erickson" type couplings in lieu of running threads.
- O. PVC Conduit:
 - 1. Joints: Conduits shall be joined by using couplings and solvent cement furnished or recommended by the raceway manufacturer. Finished joints shall be secure and watertight.
 - 2. Cutting: Cutting shall be done with hacksaws and ends shall be reamed to remove burrs and sharp edges.

3. Expansion Joints: Expansion joints shall be installed:
 - a. Where conduit run crosses a building expansion joint.
 - b. As recommended by the manufacturer or as shown on the drawings.

4. Bends for PVC conduit sizes 2" and smaller may be made "hot" in the field. Inside dimension shall be thereby undistorted. For PVC sizes larger than 2", provide only factory bends.

END OF SECTION 26 05 33

SECTION 26 22 00 - DRY-TYPE TRANSFORMERS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of transformer work is indicated by drawings and schedules.
- B. Types of transformers specified in this Section include the following:
 - 1. Energy Efficient Dry-type Transformers
 - 2. Shielded, Isolation Type Transformers
- C. Refer to other Division 26 sections for electrical wiring connections required in conjunction with transformers; not work of this Section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the manufacture of power distribution transformers of types and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer: Qualified with at least three (3) years successful installation experience on projects with electrical power/distribution transformer work similar to that required for this project.

1.4 REFERENCES

- A. NEC Compliance: Comply with NEC as applicable to installation and construction of electrical power/distribution transformers.
- B. NEMA Compliance: Comply with applicable portions of the NEMA Std. Pub. Nos. TR1 and TR27 pertaining to power/distribution transformers.
- C. ANSI Compliance: Comply with applicable ANSI standards pertaining to power/distribution transformers.
- D. ANSI/IEEE Compliance: Comply with applicable ANSI/IEEE standards pertaining to power/distribution transformers..
- E. ANSI/NEMA Compliance: Comply with NEMA Std. ST 20 "Dry-Type Transformers for General Applications".
- F. ANSI/UL Compliance: Comply with applicable portions of ANSI/UL 506 "Safety Standard for Specialty Transformers".
- G. UL Labels: Provide distribution transformers that have been UL listed and labeled.

- H. IECC Compliance: Transformers shall be fully compliant with provisions of the International Energy Conservation Code, 2018 Edition.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data including KVA rating, frequency, primary and secondary voltages, percent taps, impedance and certification of transformer performance efficiency at indicated loads, no load and full load losses in watts, hot spot and average temperature rise above 40 degrees C ambient, sound level in decibels, and standard published data.
- B. Shop Drawings: Submit manufacturer's drawings indicating dimensions and weight loading for transformer installations.

2. PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of transformer):

- A. Cutler Hammer
- B. General Electric Co.
- C. Square D Co.
- D. Siemens

2.2 EQUIPMENT

2.3 Furnish and install dry-type transformers as shown on the drawings.

- A. Transformer coils shall be of the continuous **copper wound construction**.
- B. All transformer cores shall be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating. There shall be no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.
- C. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.
- D. The transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL recognized for outdoor use. The coating color shall be ANSI 49.
- E. Dry-type transformers shall have metallic enclosures designed to provide for air cooling and to prevent accidental contact with live conductors. Materials and final performance of the product must conform to applicable IEEE and NEMA standards. Transformer wiring compartment shall be located below the core and coil, and shall be cooled by air circulation, or the wiring compartment shall be insulated from the core and coil by means of a suitable thermal insulation barrier. All transformers shall be UL listed and shall bear the UL label.

- F. Transformers shall operate at 100% nameplate KVA rating continuously while in a 40 degrees C ambient environment without exceeding the rated average winding temperature rise of the ANSI insulated system used. Specific KVA and voltage ratings required shall be as shown on the drawings. Transformers rated above 30 KVA shall have a 220 degrees C insulation system with 150 degrees C average temperature rise or 180 degrees C hot spot rise in a 40 degrees C ambient. Transformers rated 30 KVA and below shall have a 180 degrees C insulation system with 115 degrees C average temperature rise or 145 degrees C hot spot rise in a 40 degrees C ambient.
- G. Sound levels must fall within ANSI-NEMA Standard levels according to KVA size.
- H. Sound levels shall be warranted by the manufacturer not to exceed the following:
 - 1. 15 to 50KVA - 45dB; 51 to 150kVA - 50dB; 151 to 300kVA - 55dB; 301 to 500kVA - 60dB; 501 to 700kVA - 62dB; 701 to 1000kVA - 64dB; 1001 to 1500kVA - 65dB; 1501 to 2000kVA- 66Db.
- I. All transformers shall be supplied with clamp-type solderless connectors suitable for use with copper connecting cables.
- J. All transformers shall have neoprene rubber pads between the core and coil assembly and the transformer enclosure to isolate sound and vibration. A flexible conduit connection to the transformer may be used.
- K. Terminal boards shall be provided on all transformers. High-voltage and low-voltage terminals must be held in a fixed position, thus removing any need for taping of cable-terminal connections.
- L. Transformers which weigh more than 50 pounds must have external lifting provisions for ease in handling.
- M. Single phase transformers over 10 KVA and three-phase transformers 6 KVA and above shall have minimum full load rated taps in the high-voltage windings as follows: four 2-1/2% full capacity taps, 2 above and 2 below normal rated voltage. Transformer taps shall be adjusted to deliver nominal system voltage at branch circuit panels.

3. EXECUTION

- 3.1 Install transformers as indicated in compliance with the manufacturers' written instructions, applicable requirements of the NEC, NEMA, ANSI and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.
- 3.2 Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.
- 3.3 Install transformers on vibration mounts; comply with manufacturers recommended installation methods, if applicable.
- 3.4 Clearances shall be maintained around transformers in accordance with all applicable codes, standards and manufacturer's installation instructions.

END OF SECTION 26 22 00

SECTION 26 24 13 - SWITCHBOARDS

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 work of this Section. Division 26 "Basic Materials and Methods" sections apply to work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. Drawings and schedules indicate extent of switchboard work.
- B. Types of switchboards specified in this Section include the following:
 - 1. Circuit Breaker Switchboards

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the manufacture of switchboards of types, sizes and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects utilizing switchboards similar to those for this project.

1.4 REFERENCES

- A. NEC Compliance: Comply with the NEC as applicable to wiring methods, construction and installation of switchboards.
- B. UL Compliance: Comply with applicable requirements of Standard 486A, "Wire Connectors and Soldering Lugs For Use With Copper Conductors", and Standard 891, "Dead-Front Electrical Switchboards", pertaining to installation of switchboards. Provide switchboards and components that are UL listed and labeled.
- C. IEEE Compliance: Comply with applicable requirements of IEEE Standard 241, "Recommended Practice for Electrical Power Systems in Commercial Buildings", pertaining to switchboards.
- D. ANSI Compliance: Comply with applicable requirements of ANSI standards pertaining to switchboard assemblies.
- E. NEMA Compliance: Comply with applicable portions of NEMA Standards Publication Number PB 2, "Dead-Front Distribution Switchboards"; PB 2.1, "Instructions for Safe Handling, Installation, Operation and Maintenance of Switchboards", and SG 3, "Low-Voltage Power Circuit Breakers", pertaining to switchboard assemblies.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's data on switchboards including, but not limited to, voltage, number of phases, frequency, short-circuit and continuous current ratings. Provide application data for main and branch circuit devices, sections, main buses, and basic insulation levels.
- B. Shop Drawings: Submit layout drawings of switchboards showing accurately scaled basic equipment sections including auxiliary compartments, section components, and combination sections.
- C. Wiring Diagrams: Submit wiring diagrams for switchboards showing connections to electrical power feeders and distribution branches. Clearly differentiate between portions of wiring that are manufacturer-installed and portions to be field-installed.

2. PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide switchboards of one of the following (for each type and rating of switchboard):
 - 1. Square D Company
 - 2. General Electric Company
 - 3. Cutler Hammer
 - 4. Siemens

2.2 FEEDER PROTECTIVE DEVICE COORDINATION

2.3 GENERAL CONSTRUCTION

- A. Where indicated, furnish and install an indoor dead front type, completely metal enclosed, low voltage, self-supporting switchboard structure independent of wall supports. Voltage rating shall be as indicated on the drawings. It shall consist of the required number of vertical sections bolted together to form one rigid switchboard with a nominal height of 90 inches. The sides and rear shall be covered with removable screw-on plates having formed edges all around.
- B. Equipment shall comply with the latest applicable standards of NEMA, ANSI and UL.
- C. **Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features. Include where indicated on the electrical one line diagrams.**
- D. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips.
- E. Switchboards shall be provided with adequate lifting means and shall be capable of being rolled or moved into installation position and bolted directly to the floor without the use of floor sills.
- F. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and finished with gray baked enamel over a rust-inhibiting phosphatized coating. Color shall be ANSI 49 or ANSI 61, gray.

- G. Nameplates shall be furnished for all main and feeder circuits including control fuses for all indicating lights and instruments. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish Master Nameplate giving switchboard designation, voltage and ampere rating, bracing, manufacturer's name, general order number and item number.
- H. Provide flash hazard labeling in accordance with National Electrical Code requirements.
- I. All bus bars shall be plated copper. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL standard 891 temperature rise requirements. The phase and neutral through-bus shall have ampacities as indicated on the drawings. The neutral bus shall be of equivalent ampacity to the phase bussing. Tapered bus is not acceptable. Full provisions for the addition of future switchboard sections shall be provided. Bus connections shall be bolted with Grade 5 bolts and conical spring washers. The ground bus shall be sized in accordance with NEC and UL 891 requirements and shall extend the entire length of the switchboard. The bus work shall be braced for 100,000 RMS symmetrical amps at rated voltage. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. All hardware used on conductors shall have high-tensile strength zinc plating. All terminals shall be of the anti-turn solderless type suitable for Cu and Al cable of sizes indicated.
- J. Furnish cable pull sections or cable pull boxes as required complete with cable tie down supports. Where cable pull section or pull boxes contain utility service cables provide utility acceptable sealing means.
- K. All factory-installed devices shall be re-torqued prior to energizing.
- L. Coordination: The equipment dimensions indicated on the drawings are based on Square D published data. If other acceptable manufacturer's equipment is proposed and exceeds these dimensions, it shall be the responsibility of the Contractor to coordinate the equipment arrangement within the room with all affected trades to provide all code clearances and proper arrangements. Switchboards that grossly exceed the space allocated and that would require an increase in room size are not acceptable.

2.4 SWITCHBOARD TYPE

- A. Switchboards shall be of construction equal to Square D Power-Style, QED type. Each main switchboard shall be front accessible. Switchboard sections shall be no greater than 91.5" in height, including 1.5" floor sills.

2.5 CUSTOMER METERING

- A. Where indicated on the drawings, digital electronic power meter with the following monitoring and metering capabilities:
 1. Current, per phase and neutral.
 2. Voltage, phase-to-phase and phase-to neutral.
 3. Real power (kW), per phase and three-phase total.
 4. Reactive power (kVAR), per phase and three phase total.
 5. Apparent power (kVA), per phase and three phase total.
 6. Power factor (true), per phase and three phase total.
 7. Frequency.
 8. Demand current, per phase and neutral, present and peak.

9. Real power demand (kWd), three phase total, present and peak.
10. Reactive power demand (kVARd), three phase total, present and peak.
11. Apparent power demand (kVAd), three phase total, present and peak.
12. Real energy (kWh), three phase total.
13. Reactive energy (kVARh), three phase total.
14. Apparent energy (kVAh) three phase total.
15. Energy accumulation modes, signed, absolute, energy in, energy out.
16. Total harmonic distortion (THD), voltage and current, per phase.
17. Date and time stamping, peak demands, power up/restart and resets.

- B. Provide all necessary components and connections from electronic power meter to Owner's Building Management System. Coordinate requirements and installation with the Owner's control representatives.
- C. The power meter shall be accurate to 0.25% of the reading plus 0.05% of the full scale for voltage and current sensing, and 0.5% of the reading plus 0.05% of the full scale for power and energy, accurate through the 31st harmonic.
- D. Provide necessary current transformers to support current inputs to the power meter. Provide potential transformers, control power transformers, and fusing as required.
- E. Each power meter shall have a built-in RS-485 data communications port to allow for future multi-point communication to multiple computer workstations.
- F. The power meter shall include self-diagnostics to indicate mis-wired installations.

2.6 MAIN AND FEEDER PROTECTIVE DEVICES

A. MAIN PROTECTIVE DEVICES

1. Main circuit breakers shall be of the individually stationary mounted, two-steps stored energy type (Square D Masterpact, or equivalent). They shall be UL listed for 100% continuous current when applied in Square D QED style switchboards. Sensor and frames ratings shall be as shown in the drawings.
2. Main protective devices shall be provided with a fixed instantaneous (high-level selective override) circuit. The circuit shall have a defeatable instantaneous adjustment to allow the breaker to remain closed for up to 30 cycles during overcurrents that are below the rms symmetrical short time withstand ratings. The circuit shall instantaneously trip when current levels exceed applicable withstand ratings.
3. Main circuit breakers shall use a glass reinforced insulating material providing high dielectric strength. Current carrying components of the circuit breakers shall be completely isolated from the handle and the accessory mounting area. Breakers shall have common tripping of all poles and shall be trip free. Circuit breakers shall be UL Listed for reverse connection without requiring special construction or labeling. The breakers shall have quick-make, quick-break contacts with a maximum 5 cycle closing time. Circuit breakers shall be equipped with electrical accessories as noted on the drawings.
4. Main circuit breakers shall be factory sealed and shall have a date code on the face of the circuit breaker. Poles shall be labeled with respective phase designations.
5. Breaker faceplates shall indicate rated ampacities, and UL and IEC certification standards with applicable voltage systems and corresponding AIC ratings.
6. Each circuit breaker shall be equipped with a push-to-trip button to mechanically operate the circuit breaker tripping mechanism.

7. Each main circuit breaker shall be provided with a true two step, stored energy mechanism for 5-cycle closing. The energy required to close the circuit breaker shall be stored pending release to close action. Main circuit breakers shall have multiple CHARGE/CLOSE provisions allowing the following sequence: CHARGE, CLOSE, RECHARGE, OPEN/CLOSE/OPEN.
8. Each main circuit breaker shall be provided with local control push buttons to OPEN and CLOSE the circuit breaker. Color-coded visual indication of contact position (OPEN or CLOSED) shall be provided on the front of the breaker. Each circuit breaker shall provide for local manual charging following a CLOSE operation. Color-coded visual indication of the mechanism CHARGED and DISCHARGED position shall be provided on the face of the circuit breaker. The visual indicator shall indicate CHARGED only when closing springs are completely charged.
9. The entire trip system shall be a microprocessor-based, true rms sensing design (Square D MICROLOGIC Full Function or approved equivalent) with sensing accuracy through the 13th harmonic. Provide the following time/current curve adjustments to maximize system selective coordination capabilities. Each adjustment shall have discrete settings and each function shall be independent from all other adjustments.
 - a. Adjustable long time ampere rating and delay.
 - b. Adjustable short time pickup and delay (delay includes I²t IN and I²t OUT).
 - c. Adjustable defeatable instantaneous pickup (with OFF position).
 - d. Adjustable ground fault pickup and delay (delay includes I²t IN and I²t OUT).
 - e. High level selective override.
10. Each circuit breaker trip system shall include an externally accessible test port for use with a universal equipment test set. One test set will be provided to the Owner with the switchboard and shall be suitable for testing all electronic circuit breakers specified for this project. No disassembly of circuit breakers shall be required for testing.
11. Circuit breaker lugs shall be UL Listed to accept solid or stranded copper conductors only. Lugs shall be suitable for 75°C wire, or 90°C wire sized in accordance with the 75°C temperature rating in the NEC. All circuit breakers shall be UL Listed to accept field installable/removable compression type lugs. All circuit breakers shall be suitable for bus connection.
12. For all circuit breakers rated 1200 Amps or more, provide circuit breaker with an energy reducing maintenance switch per NEC paragraph 240.87.

B. FEEDER PROTECTIVE DEVICES

1. Feeder protective devices as shown shall be molded case air circuit breakers, built, tested and UL labeled per UL 489.
2. Breakers with 100 ampere through 400-ampere frames shall be thermal-magnetic trip with inverse time current characteristics. Breakers with 225 ampere through 400-ampere frames shall have continuously adjustable magnetic pick-ups of approximately five to ten times trip rating.
3. Breakers with 600 ampere frames and above shall be Square D Powerpact or approved equivalent with solid-state trip complete with built in current transformers, solid-state trip unit and flux transfer shunt trip. Breakers shall have easily changed trip-rating plugs with trip ratings as indicated on the drawings. Rating plugs shall be interlocked so they are not interchangeable between frames and interlocked such that breakers cannot be latched with rating plug removed. Breaker shall have built-in test points for testing long delay, instantaneous and ground fault (where shown). Functions of the breaker shall be tested by means of a 120 volt operated test kit. Provide one test kit capable of testing all breakers 600 ampere and above.

4. Solid state instantaneous element shall be continuously adjustable from approximately 4 to 8 times the trip rating, with short time adjustment from instantaneous to 10-cycle delay for coordination purposes. Provide short delay override feature providing for instantaneous tripping on high magnitude faults.
5. Molded case breakers shall have a minimum UL listed interrupting capacity as listed on the drawings.
6. For all circuit breakers rated 1200 Amps or more, provide circuit breaker with an energy reducing maintenance switch per NEC paragraph 240.87.
7. Breakers 2000 thru 3000A frame on the drawings shall be UL listed and labeled for 100 percent application per the N.E.C.

2.7 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) EQUIPMENT

- A. Where indicated on the drawings, provide switchboards with integral TVSS equipment according to the following:
- B. Transient voltage surge suppression (TVSS) equipment shall be designed for non-linear loads incorporating transient voltage surge suppression and high-frequency electrical line noise filtering connected in parallel with the facility's wiring system. The specified unit shall be suitable for non-linear loads and shall provide effective high-energy transient voltage suppression, surge current diversion, high-frequency electrical line noise attenuation, and line control in ANSI/IEEE C62.41-1991 environments when connected downstream from the facility's main overcurrent device.
- C. The manufacturer of the unit must have been engaged in the design and manufacture of such products for a minimum of five years.
- D. The specified unit shall be designed, manufactured, tested and installed in compliance with the latest edition of the following standards:
 1. ANSI/IEEE C62.41, C62.45
 2. FIPS PUB 94
 3. NEMA LS-1
 4. NFPA 70, 75 and 78
 5. UL 50, 67, 489, 943, 1283 and 1449.
- E. The unit shall be UL 1449, third edition listed as a transient voltage surge suppression unit.
- F. Environmental Requirements
 1. Operating temperature range shall be -40 degrees to +60 degrees C.
 2. Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.
 3. The unit shall not generate audible noise greater than 35 dB at 3 feet from the unit.
 4. No appreciable magnetic fields shall be generated. The unit shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.
- G. Electrical Requirements
 1. The nominal unit operating voltage and configuration shall be as indicated on the drawings.

2. The maximum continuous operating voltage of all suppression components utilized in the unit shall not be less than 115% of the facility's nominal operating voltage.
3. The operating frequency range of the unit shall be 47 to 63 Hertz.
4. The unit's primary mode of protection shall be line-to-neutral. The secondary modes of protection shall be line-to-ground and neutral-to-ground.
5. Based on ANSI/IEEE C62.41-1991's standard 8 x 20 microsecond current waveform, the maximum repetitive surge current capacity, in amps, of the unit shall be no less than 100 KA per mode.
6. The unit's published performance ratings shall be the UL 1449 Listed suppression ratings. The UL 1449 suppression rating shall be, for each mode of protection and system voltage as follows:
 - a. L-L: 1500 Volts for 480Y/277 Volt, 3 phase, 4 wire systems, 700 Volts for 208Y/120 Volt, 3 phase, 4 wire systems and 240/120 Volt 1 phase, 3 wire systems.
 - b. L-N: 800 Volts for 480Y/277 Volt 3 phase, 4 wire systems, 400 Volts for 208Y/120 Volt 3 phase, 4 wire systems and 240/120 Volt 1 phase, 3 wire systems.
 - c. L-G: 1500 Volts for 480Y/277 Volt 3 phase, 4 wire systems, 700 Volts for 208Y/120 Volt 3 phase, 4 wire systems and 240/120 Volt 1 phase, 3 wire systems.
 - d. N-G: 800 Volts for 480Y/277 Volt 3 phase, 4 wire systems, 400 Volts for 208Y/120 Volt 3 phase, 4 wire systems and 240/120 Volt 1 phase, 3 wire systems.

3. EXECUTION

3.1 GENERAL

- A. Inspection: Installer must examine areas and conditions under which switchboards and components are to be installed and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
- B. Coordinate with other work including electrical cabling and wiring, as necessary to interface installation of switchboards.
- C. Tighten connections and terminals including screws and bolts, in accordance with equipment manufacturers published torque-tightening values for equipment connectors. Where manufacturers torque requirements are not indicated, tighten connectors and terminals to comply with tightening torque's specified in UL Standard 486A.
- D. Set all adjustable circuit breaker elements according to the coordination study submitted.

END OF SECTION 26 24 13

SECTION 26 24 16 - PANELBOARDS

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 the work of this Section.
- B. This Section is a Division 26 "Basic Materials and Methods" section, and is a part of each Division 26 section making reference to panelboards specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of panelboard and enclosure work, including cabinets and cutout boxes is indicated on the drawings and by schedules.
- B. Types of panelboards and enclosures in this Section include the following:
 - 1. Distribution Panels
 - 2. Lighting and Appliance Panels
 - 3. Transient Voltage Surge Suppression (TVSS) Panels
- C. Refer to other Division 26 sections for cable/wire, connectors and electric raceway work required in conjunction with panelboards and enclosures; not work of this Section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the manufacture of panelboards and enclosures, of types, size and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer: A firm of at least three (3) years of successful installation experience on projects with electrical installation work similar to that required for this project.

1.4 REFERENCES

- A. Special Use Markings: Provide panelboards, constructed for special use, with UL markings indicating that special type usage. Panels identified or shown on the drawings for use as main service entrance equipment shall be labeled at the factory with "SERVICE ENTRANCE" type UL label.
- B. UL Compliance: Comply with applicable UL safety standards pertaining to panelboards, accessories, and enclosures. Provide units which have been UL listed and labeled. UL standards are as follows:
 - 1. Panelboards - UL67
 - 2. Cabinets and Boxes - UL50

- C. NEC Compliance: Comply with the NEC as applicable to the installation of panelboards, cabinets, and cutout boxes.
- D. NEMA Compliance: Comply with NEMA Stds. Pub. No. 250 "Enclosures for Electrical Equipment (1000 volt maximum)", Pub. No. 1 "Panelboards" and Pub. No. PB1.1, "Instruction for Safe Installation, Operation, and Maintenance of Panelboards Rates 600 Volts and Less".
- E. NECA Compliance: Comply with NECA's "Standard of Installation".

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations for each panelboard required. Include data substantiating that units comply with specified requirements.
- B. Shop Drawings: Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures and required individual panelboard devices, including but not limited to circuit breakers, fusible switches, fuses, ground fault circuit interrupters, and accessories.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements provide products of one of the following:
 - 1. Square D Company
 - 2. General Electric
 - 3. Cutler Hammer
 - 4. Siemens

2.2 FEEDER PROTECTIVE DEVICE COORDINATION

2.3 GENERAL

- A. Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials, and which are designed and constructed in accordance with published product information. Provide solderless lugs, or connectors, in the correct number and size for conductors on mains, on the load side of each branch, circuit, and on ground and neutral bars. Provide tin plated copper busses. Provide an insulated neutral bus and a bonded equipment ground bus mounted at the opposite end of the structure from the mains, and having numbered screw or lug terminals for connection of wires. Equip panels with the number of unit devices as required for a complete installation. Where more than one type of component meets the indicated requirements, selection is installer's option. Where types, sizes or ratings are not indicated, comply with NEC, UL and established industry standards for applications indicated.
- B. Provide ground fault circuit interrupting type circuit breakers for all devices noted with a "GFI" subscript on the panelboard schedules for this project.

- C. Provide UL listed HACR type circuit breakers for all devices which serve heating, ventilating, or air conditioning equipment.
- D. Panelboards shall be provided with covers for surface or flush mounting as shown on the drawings, or as required for actual project conditions.
- E. Panelboards shall be constructed for top or bottom feeder service, as required by actual project conditions.

2.4 LIGHTING AND APPLIANCE PANELS

- A. Lighting and appliance panelboards shall be Square D type NF (or equal) for 277/480 volt or Square D type NQOB (or equal) 120/208 volt applications. All branch circuit breakers are to be quick-make, quick-break, trip indicating and common trip on all multi-pole breakers, and shall be bolt-on type. Trip indication shall be clearly shown by breaker handle located between the "ON" and the "OFF" positions. Panelboards shall have distributed phase copper bussing throughout.
- B. Review drawings and provide main circuit breaker type panels where indicated on the drawings. Additionally, provide main lug only type panels where indicated on the drawings.**
- C. Provide fully rated main circuit breaker or main lug only (see drawings) type panelboards where the short circuit rating of the complete panelboard assembly is determined by the lowest rated branch device. Provide panelboard interrupting ratings as noted on the drawings.
- D. Lighting and appliance panels shall be 5.75" deep, maximum and shall have 6-inch minimum gutters. Fronts are to be complete with door and cylinder lock, with all locks keyed alike. Fronts shall have adjustable trim clamps, directory frames, and shall be equipped with a typewritten directory that identifies each circuit breaker by number and the equipment that the breaker serves. One additional blank directory card for each panel shall be furnished to the Owner.
- E. Two section panels (as required by Code) shall be equipped with boxes of equal dimensions.
- F. Panelboards shall be Underwriters' Laboratory listed and shall bear the UL label. The size of the panelboard main disconnect device or main lugs, the rating and number of branch circuits, and the type of mounting shall be as shown on the drawings.
- G. All factory installed devices shall be re-torqued prior to energizing.

2.5 DISTRIBUTION PANELS

- A. Distribution panels shall be Square D I-Line (or equal) panels as indicated on the plans. Provide appropriate type of panels to meet specific project requirements. Panelboards shall have distributed phase copper bussing throughout.
- B. Circuit breakers shall be as specified for lighting panels unless indicated otherwise. Power panels shall have combination card holder and name-plate and shall be equipped with typewritten directories that identify all loads served and all spare circuits. Provide a copper ground bus in all power panels.

- C. Power panels shall be Underwriters' Laboratory approved and shall bear the UL label. Main lugs and gutters shall be suitable for copper and aluminum wire. The size of the panelboard main protective device or main lugs, the size, type and the number of branch circuits and the type of mounting shall be as shown on the drawings.
- D. **Review drawings and provide main circuit breaker type panels where indicated on the drawings. Additionally, provide main lug only type panels where indicated on the drawings.**
- E. Provide fully rated main circuit breaker or main lug only (see drawings) type panelboards where the short circuit rating of the complete panelboard assembly is determined by the lowest rated branch device. Provide panelboard interrupting ratings as noted on the drawings.

2.6 FEEDER PROTECTIVE DEVICES

1. The following paragraphs list the general feeder protective device requirements.

- a. Feeder protective devices as shown shall be molded case air circuit breakers, built, tested and UL labeled per UL 489.
- b. In general 100 ampere through 400-ampere frames shall be thermal-magnetic trip with inverse time current characteristics. Breakers with 225 ampere through 400-ampere frames shall have continuously adjustable magnetic pick-ups of approximately five to ten times trip rating.
- c. In general breakers with 600 ampere frames and above shall be Square D Powerpact or approved equivalent with solid-state trip complete with built in current transformers, solid-state trip unit and flux transfer shunt trip. Breakers shall have easily changed trip-rating plugs with trip ratings as indicated on the drawings. Rating plugs shall be interlocked so they are not interchangeable between frames and interlocked such that breakers cannot be latched with rating plug removed. Breaker shall have built-in test points for testing long delay, instantaneous and ground fault (where shown). Functions of the breaker shall be tested by means of a 120 volt operated test kit. Provide one test kit capable of testing all breakers 600 ampere and above.
- d. Solid state instantaneous element shall be continuously adjustable from approximately 4 to 8 times the trip rating, with short time adjustment from instantaneous to 10-cycle delay for coordination purposes. Provide short delay override feature providing for instantaneous tripping on high magnitude faults.
- e. Molded case breakers shall have a minimum UL listed interrupting capacity as listed on the drawings.
- f. Breakers 2000 thru 3000A frame on the drawings shall be UL listed and labeled for 100 percent application per the N.E.C.
- g. For all circuit breakers rated 1200 Amps or more, provide circuit breaker with an energy reducing maintenance switch per NEC paragraph 240.87

2.7 CUSTOMER METERING

- A. Where indicated on the drawings, provide digital electronic power meters with the following monitoring and metering capabilities:
 - 1. Current, per phase and neutral.
 - 2. Voltage, phase-to-phase and phase-to neutral.
 - 3. Real power (kW), per phase and three-phase total.
 - 4. Reactive power (kVAR), per phase and three phase total.

5. Apparent power (kVA), per phase and three phase total.
6. Power factor (true), per phase and three phase total.
7. Frequency.
8. Demand current, per phase and neutral, present and peak.
9. Real power demand (kWd), three phase total, present and peak.
10. Reactive power demand (kVARd), three phase total, present and peak.
11. Apparent power demand (kVAd), three phase total, present and peak.
12. Real energy (kWh), three phase total.
13. Reactive energy (kVARh), three phase total.
14. Apparent energy (kVAh) three phase total.
15. Energy accumulation modes, signed, absolute, energy in, energy out.
16. Total harmonic distortion (THD), voltage and current, per phase.
17. Date and time stamping, peak demands, power up/restart and resets.

- A. Provide all necessary components and connections from electronic power meter to Owner's Building Management System. Coordinate requirements and installation with the Owner's control representatives.
- B. The power meter shall be accurate to 0.25% of the reading plus 0.05% of the full scale for voltage and current sensing, and 0.5% of the reading plus 0.05% of the full scale for power and energy, accurate through the 31st harmonic.
- C. Provide necessary current transformers to support current inputs to the power meter. Provide potential transformers, control power transformers, and fusing as required.

2.8 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) PANELS

- A. Transient voltage surge suppression (TVSS) panels shall be designed for non-linear loads incorporating transient voltage surge suppression and high-frequency electrical line noise filtering connected in parallel with the facility's wiring system. The specified unit shall be suitable for non-linear loads and shall provide effective high-energy transient voltage suppression, surge current diversion, high-frequency electrical line noise attenuation, and line control in ANSI/IEEE C62.41-1991 environments when connected downstream from the facility's main overcurrent device. Comply with all requirements of this specification for lighting and appliance and distribution panels.
- B. The manufacturer of the unit must have been engaged in the design and manufacture of such products for a minimum of five years.
- C. The specified unit shall be designed, manufactured, tested and installed in compliance with the latest edition of the following standards:
 1. ANSI/IEEE C62.41, C62.45
 2. FIPS PUB 94
 3. NEMA LS-1
 4. NFPA 70, 75 and 78
 5. UL 50, 67, 489, 943, 1283 and 1449.
- D. The unit shall be UL 1449, second edition listed as a transient voltage surge suppression unit.
- E. Environmental Requirements

1. Operating temperature range shall be -40 degrees to +60 degrees C.
2. Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.
3. The unit shall not generate audible noise greater than 35 dB at 3 feet from the unit.
4. No appreciable magnetic fields shall be generated. The unit shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.

F. Electrical Requirements

1. The nominal unit operating voltage and configuration shall be as indicated on the drawings.
2. The maximum continuous operating voltage of all suppression components utilized in the unit shall not be less than 115% of the facility's nominal operating voltage.
3. The operating frequency range of the unit shall be 47 to 63 Hertz.
4. The unit's primary mode of protection shall be line-to-neutral. The secondary modes of protection shall be line-to-ground and neutral-to-ground.
5. Based on ANSI/IEEE C62.41-1991's standard 8 x 20 microsecond current waveform, the maximum repetitive surge current capacity, in amps, of the unit shall be no less than 100 KA per mode.
6. The unit's published performance ratings shall be the UL 1449 Listed suppression ratings. The UL 1449 suppression rating shall be, for each mode of protection and system voltage as follows:
 - a. L-L: 700 Volts for 208Y/120 Volt, 3 phase, 4 wire systems.
 - b. L-N: 400 Volts for 208Y/120 Volt 3 phase, 4 wire systems.
 - c. L-G: 700 Volts for 208Y/120 Volt 3 phase, 4 wire systems.
 - d. N-G: 400 Volts for 208Y/120 Volt 3 phase, 4 wire systems.

G. Documentation and Testing

1. The manufacturer shall furnish an equipment manual with installation, operation and maintenance instructions for the specified unit.
2. Documentation of the unit's UL 1449 suppression rating shall be included as required product data submittal information. Manufacturer shall make available upon request certified documentation of applicable Location Category Testing in full compliance with ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1987 guidelines.
3. A list of customer-replaceable spare parts shall be included in the unit's installation, operation and maintenance instructions. All spare parts shall be quickly and easily field-replaceable.
4. The TVSS device repetitive surge current capacity shall be tested utilizing a 1.2 x 50 microsecond waveform as defined by ANSI/IEEE 62.41-1991 and ANSI/IEEE 62.45-1992 at one minute intervals. A failure is defined as either performance degradation or more than 10% deviation of clamping voltage at the specified surge current. The device shall be capable of surviving 5000 impulses without failure or performance degradation.
5. The unit shall be factory tested and burned in at the applicable MCOV for a minimum of one hour.
6. The unit shall be provided with a five-year warranty.
7. The unit shall be thoroughly factory-tested before shipment. Testing of each unit shall include but shall not be limited to quality assurance checks, MCOV and clamping voltage verification tests.

H. Construction

1. Panel trim, box, interior, bus and circuit breakers shall be as specified for lighting and appliance panels and on the drawings. The TVSS shall be mounted integral to the panelboard equipment and shall not violate the equipment manufacturer's UL label.

I. Suppression/Filter System

1. The unit shall include an engineered solid-state high-performance suppression system, utilizing arrays of fused non-linear voltage dependent metal oxide varistors with similar operating characteristics. The suppression system's components shall optimally share surge currents in a seamless, low-stress manner assuring maximum performance and proven reliability. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads. The suppression system shall not incorporate any other components which may degrade performance or reliability of the suppression system.
2. The fusing system shall be capable of allowing the rated maximum surge current to pass through without fuse operation. Systems utilizing a fusing system that opens below the maximum surge current level are unacceptable.
3. The unit shall include an EMI/RFI noise suppression filter capable of a minimum of -40 dB attenuation at 100 kHz.
4. Any TVSS unit mounted in a distribution panel shall have an integral disconnect or circuit breaker to be used as a means of disconnecting the suppression/filter system for maintenance and/or test purposes without interruption of power to the facility's distribution system.
5. All internal wiring associated with the suppression/filter system and subject to surge currents shall utilize low-impedance copper bus bar and/or #8 AWG copper conductor or larger. All internal connections associated with the suppression/filter system and subject to surge currents shall be made with compression solderless-type lugs and shall be bolted to the bus bars in order to reduce overall system impedance. No plug-in component modules, quick-disconnect terminals or printed circuit boards shall be used in surge current-carrying paths.
6. The unit shall include the following accessories:
 - a. The unit shall include Form C dry contacts (N.O. and N.C.) to facilitate connection to a building management system in order to monitor the on-line status of the unit. The contacts shall be normally open or normally closed and shall close or open upon failure of the suppression system and/or fuse.
 - b. Operational status indicating lights.
 - c. Audible alarm and alarm indicating light.
 - d. Transient Voltage surge counter with battery backup.

3. EXECUTION

3.1 INSTALLATION

- A. General: Install panelboards and enclosures where indicated, in accordance with the manufacturers' written instructions, applicable requirements of the NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Coordinate the installation of panelboards and enclosures with cable and raceway installation work.

- C. Provide all required electrical connections within the enclosure.
- D. Fill out typewritten panelboard circuit directory cards upon completion of the installation work.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

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 work of this Section.
- B. This section is a Division 26 "Basic Materials and Methods" section, and is a part of each Division 26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry, but not utilize electrical energy.
- B. Types of electrical wiring devices in this Section include the following:
 - 1. Receptacles
 - 2. Switches
 - 3. Wall Plates
 - 4. Lighting Controls

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of wiring devices of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer: Qualified with at least 2 years of successful installation experience on projects with electrical installation work similar to that required for this project.

1.4 REFERENCES

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring devices.
- B. UL Compliance and Labeling: Provide electrical wiring devices which have been UL listed and labeled.
- C. NEMA Compliance: Comply with NEMA standards for general and specific purpose wiring devices.
- D. NECA Compliance: Comply with NECA's "Standard of Installation."

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's data on electrical wiring devices.

2. PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following:

1. Pass and Seymour Corporation
2. Cooper
3. Hubbell, Inc.
4. Leviton, Inc.
5. Crouse Hinds
6. Lutron

2.2 WIRING DEVICES

A. General: Where shown on the drawings, furnish and install wiring devices indicated by the appropriate symbols. Wiring devices shall be products of Pass and Seymour Corporation, or equal. Catalog numbers shown below are P & S hard use specification grade. Similar devices manufactured by Hubbell or Leviton shall be equally acceptable.

B. 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. LED and Fluorescent Dimmer Switches: Provide dimmer switches capable of 0-10 Volt dimming of LED. See plans for manufacturer and model numbers.

C. Occupancy Sensors/Switches, Time Switches, Lighting Control System

1. Basis of design for digital lighting control system is Acuity nLight system.
2. Wattsoppe Digital Light Management (DLM) and Hubbell NX lighting control systems are approved equivalents for the specified nLight basis of design lighting control system.
3. See plans for manufacturer, model number, and additional lighting control information.

D. Line Voltage 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. Wall Mounted Line Voltage Digital Time Switches: Watt Stopper type TS-400-G-120/277-Gray with adjustments set as directed by the Owner.

2.3 RECEPTACLES

A. 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. Similar devices manufactured by Hubbell or Leviton shall be equally acceptable:

1. Duplex Convenience Receptacles CRB5362 Series-Gray
20A-125V (Grounding Type)
2. Weatherproof Duplex Receptacles CRB5362-Gray-WP Series- with
20A-125V (Grounding Type) Weatherproof Plate

- | | | |
|----|--|----------------------------------|
| 3. | Duplex GFI Receptacle
20A-125V | 2095 Series-Gray |
| 4. | Weatherproof Duplex
GFI Receptacle 20A-125 Volt | 2097TRWR-Gray with WP Wall Plate |
| 5. | Duplex USB Receptacle | TR5362USB-Gray |
| 6. | Tamper Resistance Receptacle | TR63-Gray for Normal |

2.4 PLATES

- A. Furnish and install wall plates for all wiring devices. Where switches and/or receptacles are shown adjacent to each other, provide a common cover plate for each group of devices. Oversize plates are not acceptable.
1. Plates shall be Pass and Seymour Type 302 stainless steel.
 2. Cover plates for all electrical devices shall be engraved with panel and circuit no. designation. Engraving shall be 1/8" high, block style letters, with black filler on front side of cover plates.
 3. Weatherproof switch plates shall be Crouse Hinds DS185 type.
 4. Weatherproof receptacle plates shall be Crouse Hinds WLRD1 type.
 5. "In-Use" Weatherproof plates shall be Intermatic WP5000 Series. Provide necessary number of gangs, mounting bases, inserts and gaskets. In-use covers shall be used in all wet location areas as defined by NEC 406.9(B)(1).

2.5 TWO PIECE SURFACE METAL RACEWAYS

- A. Where indicated on the drawings, provide Wiremold (or equivalent) Series ALA4800 two-piece, aluminum, surface metal raceway systems complete with all necessary electrical and telecommunications devices, bases, covers, dividers, wire clips, couples, inserts, end fittings, device mounting brackets, device covers, etc. to ensure a complete and functional installation.
- B. Cover plates for all power devices installed in two piece surface metal raceways shall be engraved with panel and circuit no. designation. Engraving shall be 1/8" high, block style letters, with black filler.

3. EXECUTION

3.1 INSTALLATION

- A. Install wiring devices as indicated in compliance with manufacturer's written instructions, applicable requirements of the NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices and other work.
- C. Testing: Test wiring devices for electrical continuity of grounding connections and proper polarity. Test wiring devices to demonstrate compliance with requirements.
- D. Where devices are installed on exposed fittings or boxes, the plates shall be galvanized and of a type designed to fit the box. Blank covers shall be installed on all boxes without devices or fixtures, of same type as installed on devices in the room or area.

- E. All outlets shall be located as shown on the drawings, except that where practicable, outlets shall be located in center of panels or trim or otherwise symmetrically located to conform with existing structural layout. Outlets incorrectly installed shall be corrected. Damaged items or damaged finishes shall be repaired or replaced at no expense to the Owner.
- F. Outlets 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 the same.
- G. 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.
- H. Where devices are shown near wall openings, coordinate location if corner guards are to be installed so that cover plates do not require cutting.
- I. Where devices are shown mounted adjacent to one another on the drawings, provide multi-gang faceplates to cover all devices.

END OF SECTION 26 27 26

SECTION 26 29 13 - MOTOR CONTROLLERS

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 the work of this Section.
- B. Division 26 "Basic Electrical Materials and Methods" section apply to the work specified in this Section.
- C. Control Devices: Division 23 control devices such as aquastats, electric-pneumatic and pneumatic-electric switches, thermostats, freezestats, etc. are furnished and connected by the Division 23 Contractor unless specifically noted otherwise.
- D. Motors: All motors shown on the drawings shall be furnished and set in place under the specific section in which the motor is specified.
- E. Motor starters specified in other sections of this specification such as Division 23 shall be provided with power wiring by the Division 26 Contractor.

1.2 DESCRIPTION OF WORK

- A. Extent of motor starter work is indicated by drawings and schedules.
- B. Type of motor starters specified in this Section are as follows:
 - 1. Full Voltage Non-Reversing Magnetic Starters
 - 2. Reduced Voltage Starters
 - 3. Manual Motor Starters
 - 4. Remote Controls

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the manufacture of motor starters of types, ratings and characteristics required, whose products have been in satisfactory operation in similar service for not less than five (5) years.
- B. Firm with at least three (3) years of successful installation experience on projects utilizing motor starters similar to that required for this project.

1.4 REFERENCES

- A. NEC Compliance: Comply with NEC requirements as applicable to wiring methods, construction, and installation of motor starters.
- B. NFPA Compliance: Comply with applicable requirements of NFPA standard 70E "Standard for Electrical Safety Requirements for Employee Workplaces."

- C. UL Compliance: Comply with applicable requirements of UL 486A "Wire, Connectors, and Soldering Lugs for Use with Copper Connectors," and UL 508 "Electrical Industrial Control Equipment" pertaining to the installation of motor starters. Provide motor starters and components which are UL listed and labeled.
- D. IEEE Compliance: Comply with applicable requirements of IEEE Standard 241 "Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to motor starters.
- E. NEMA Compliance: Comply with applicable requirements of NEMA Standard ICS 2, "Industrial Control Devices, Controllers and Assemblies," and Pub. No. 250, "Enclosures for Electrical Equipment (1000 volts Maximum)" pertaining to motor controllers/starters and enclosures.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's data on motor starters.
- B. Provide shop drawings of equipment being provided and control diagrams for each motor starter.

2. PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the requirements, provide motor starters of one of the following:
 - 1. Allen Bradley Co.
 - 2. General Electric Co.
 - 3. Siemens
 - 4. Square D Co.

2.2 GENERAL

- A. Except as otherwise indicated, provided motor starters and ancillary components which comply with the manufacturer's standard materials, and which are designed and constructed in accordance with published product information as required for a complete installation. Unless specifically indicated otherwise provide all power wiring, disconnects, starters, relays, hand-off-auto switches, pilot lights, motor connections, supports and all miscellaneous and necessary appurtenances required for a satisfactory and complete working system.

2.3 FULL VOLTAGE NON-REVERSING MAGNETIC 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. Magnetic starters shall not be less than NEMA size one.
 - 1. Each starter shall have a removable hinged cover capable of being padlocked. Enclosures shall be NEMA 1 general purpose type unless indicated otherwise. Provide watertight and dust tight enclosures for units installed outside, or as indicated on the drawings. Starters shall be provided with double break silver alloy contacts. All contacts shall be replaceable without removing wiring or the starter from the enclosure.

B. Magnetic starters shall be provided with the following additional equipment:

1. 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.
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. 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.
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.

2.4 PART WINDING REDUCED VOLTAGE MANETIC STARTERS

- A. Provide Allen-Bradley Bulletin 736 part-winding starters, closed-transition, magnetic, non-reversing, reduced-inrush, two-step type. Limit line current to a maximum of 65 percent of the locker rotor current. Coordinate and verify compatibility with the motor and driven equipment. Provide starter capable of interrupting 10 times motor full load rating.
- B. Provide starters with the equipment listed in paragraph 2.3, B above.
- C. Provide additional equipment for combination starters in accordance with paragraph 2.3, B above.

2.5 WYE-DELTA REDUCED VOLTAGE MAGNETIC STARTERS

- A. Provide Allen-Bradley Bulletin 737 wye-delta starters, magnetic, non-reversing, reduced-inrush, closed-circuit transition type. Limit the inrush line current to a maximum of 35 percent of the locked rotor current. Coordinate and certify compatibility with the motor and driven equipment. Provide three thermal overload relays in series with each winding. Provide starter capable of interrupting 10 times motor full local rating.
- B. Provide starters with the equipment listed in paragraph 2.3, B above.

2.6 AUTO-TRANSFORMER REDUCED VOLTAGE MAGNETIC STARTERS

- A. Provide Allen-Bradley Bulletin 746 auto-Transformer starters, magnetic, non-reversing, reduced-inrush, closed-circuit transition type. Provide minimum tap of 65 percent for motors 30 hp or less, and 50 percent for motors in excess of 30 hp. Limit the inrush line current to a maximum of 43 percent and 25 percent respectively, of the locked rotor current. Provide

thermal overload protection in each phase. Provide starter capable of interrupting 10 times motor full load rating.

- B. Provide starters with the equipment listed in paragraph 2.3, B above.

2.7 FULL VOLTAGE NON-REVERSING COMBINATION STARTERS

- A. Full voltage non-reversing combination starters shall be Square D Class 8538 (or equal) unless otherwise indicated. Provide additional equipment for combination starters in accordance with the requirements outlined in paragraph 2.3.2 above. Where combination starters are shown on the drawings, a separate starter and disconnect switch may be substituted at the Contractor's option, provided adequate space is available for the installation.
- B. Provide fused disconnect switches with Class R type fuse rejection clips. If breakers are shown, provide breakers with a minimum of 22,000 RMS symmetrical amps interrupting capacity.

2.8 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.

2.9 REMOTE CONTROLS

- A. Provide Square D standard duty oil-tight pushbuttons, pilot lights, and/or selector switches where indicated on the drawings, or wherever required for proper control of the equipment. Units shall be flush mounted in finished areas and surface mounted in unfinished areas.

3. EXECUTION

3.1 INSTALLATION

- A. Install motor starters as indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of the NEC, UL and NEMA Standards, to ensure that products fulfill requirements.
- B. Coordinate with other work including motor and electrical wiring/cabling work as necessary to interface installation of motor starters with other work.
- C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486A.
- D. Install fuses in fusible disconnect switches as required.
- E. Adjusting and Cleaning: Inspect electrical starter's operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movements.
- F. Field Quality Control: Subsequent to connecting wire/cables, energize motor starter circuitry and demonstrate functioning of equipment in accordance with specified requirements. Where necessary, correct malfunctioning units and retest to demonstrate compliance. Ensure that direction of rotation of each motor fulfills requirements.

END OF SECTION 26 29 13

SECTION 26 36 13 – MANUAL TRANSFER SWITCH

1. GENERAL

1.01 SCOPE

Furnish and install manual transfer switches (3MTS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each manual transfer shall consist of a 3 position center off mechanically held power transfer switch unit and a mechanical operating mechanism to provide complete manual operation. All transfer switches and mechanical operating mechanism shall be the product of the same manufacturer.

1.02 ACCEPTABLE MANUFACTURERS

Manual transfer switches shall be ASCO Series 300 (3MTS) or approved equivalent. Equivalent equipment by Cummins or Russ Electric is acceptable. Any alternate products shall be submitted to the consulting engineer in writing at least 10 days prior to bid. Each alternate bid must list any deviations from this specification.

1.03 CODES AND STANDARDS

The manual transfer switches and accessories shall conform to the requirements of:

- A. UL 1008 Listed for Optional Standby Transfer Switches (Manual Transfer Switches)
- B. CSA C22.2 No.178 – 1978
- C. IEC 60947-6-1 Low – Voltage Switchgear and Controller
- D. NFPA 70 - National Electrical Code
- E. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- F. UL 508 Industrial Control Equipment
- G. NEC Article 700.3 (F)
- H. International Standards Organization ISO 9001: 2008
- I. RoHs compliant (Restriction of Hazardous Substances)
- J. Seismic qualification – International Building Code & OSHPD to SDS level of 2.5

2. PRODUCTS

2.01 MECHANICALLY HELD TRANSFER SWITCH

- A. The transfer switch unit shall be manually operated and mechanically held. The switch shall be mechanically interlocked to ensure only one of three possible positions, Source 1, Source 2, or Center Off. Fused disconnect type switches shall not be acceptable.
- B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts

is minimized for maximum reliability and operating life.

- C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.
- D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors.
- E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
- F. Where neutral conductors must be switched, the MTS shall be provided with fully- rated neutral transfer contacts.
- G. The MTS shall be tested in accordance with UL 1008 for transfer switches. Switch ratings of 400 amperes shall have endurance ratings of 4000 cycles. Switch ratings of 600 – 1200 amperes shall have endurance rating of 3000 cycles.

3. OPERATION

3.01 MANUAL OPERATIONS PROVISIONS

- A. The transfer switch shall be arranged for manually actuated manual operation.
- B. The manual transfer shall be actuated via a mechanical operating mechanism.
- C. The manual operating handle shall be capable of external operation without opening the enclosure door.
- D. It shall have the same contact to contact speed as automatic operation
- E. There shall be three positions for manual operation:
 - 1. Connected to Source 1 (preferred)
 - 2. Connected to Source 2 (alternate)
 - 3. Connected to center off (disconnected position)
- F. Switch position when connected to Source 1, or Source 2 shall be pad -lockable

4. OTHER REQUIREMENTS

4.01 ENCLOSURE

- A. The 3MTS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.
- B. Enclosures shall be free standing, floor mounted.
- C. Enclosures shall be code gauge steel as per UL 50 with ANSI #61 powder coat finish.

4.02 ADDITIONAL FEATURES

- A. Mechanical position indicators (yellow) visible to the operator shall be included for Source 1 (preferred), Source 2, (alternate), and Center Off (disconnected).

- B. LED indicators shall be available for Source 1 (preferred), and Source 2 (alternate).
- C. Auxiliary position indicating contacts, rated 10 amps, 250 Vac shall be provided consisting of one closed when the MTS is connected to Source 1 (preferred), and one contact closed when the MTS is connected to Source 2 (alternate)
- D. A form A contact shall be provided to indicate switch is in the Center Off (disconnected) position.
- E. MTS shall be provided with ASCO #170BP accessory package.

4.03 WITHSTAND AND CLOSING RATINGS

- A. The MTS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the MTS terminals with the type of overcurrent protection shown on the plans. WCR MTS ratings @ 208v shall be as follows when used with specific circuit breakers or current limiting fuses:

MTS Size	Withstand & Closing Rating MCCB	W/CLF
150 - 600	50,000A	200,000

4.04 TESTS AND CERTIFICATION

- A. The complete MTS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure compliance with the specification requirements.
- B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
- C. The MTS manufacturer shall be certified to ISO 9001: 2008 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001: 2008.

4.05 WARRANTY & SERVICE

- A. The manual transfer switch shall come with a warranty of no less than 24 months from date of shipment.
- B. The MTS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

- C. The manufacturer shall maintain records of switch shipments, by serial number, for a minimum of 20 years.
- D. For ease of maintenance, the transfer switch nameplate shall include drawing numbers and serviceable part numbers.

END OF SECTION 26 36 13

SECTION 26 51 00- LIGHTING

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 the work of this Section.
- B. Division 26 "Basic Materials and Methods" sections apply to the work in this Section.

1.2 DESCRIPTION OF WORK

- A. Types of interior and exterior lighting fixtures in this Section include the following:

- 1. LED

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the manufacturer 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.
- B. Installer: Qualified with at least three years of successful installation experience on projects with interior and exterior lighting fixture work similar to that required for this project.

1.4 REFERENCES

- A. NEC Compliance: Comply with the NEC as applicable to the installation and construction of lighting fixtures.
- B. NEMA Compliance: Comply with applicable requirements of NEMA Standard Pub. Nos. LE-1 and LE-2 pertaining to lighting equipment.
- C. ANSI/UL Compliance: Comply with ANSI/UL Standards pertaining to interior and exterior lighting fixtures for hazardous locations.
- D. UL Compliance: Provide light fixtures that have been UL listed and labeled.
- E. NECA Compliance: Comply with NECA's "Standard of Installation".

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product data on lighting fixtures.
- B. SHOP DRAWINGS
 - 1. Furnish shop drawing portfolios (collated bound sets) containing the following information:

- a. Name of manufacturer
 - b. Descriptive cut sheets
 - c. Complete photometric information
 - d. Coefficient of utilization tables
 - e. Fixture voltage
 - f. The number, type and wattage of the fixture lamps
 - g. Lens types
 - h. Fixture options
 - i. Fixture mounting details
 - j. Fixture door types
 - k. Construction of fixture housing and/or door
 - l. Fixture ballast manufacturer and type
2. All lighting fixtures required to be used on this project shall be submitted in one single submittal so that all fixtures can be reviewed at one time. Those fixtures not receiving a shop drawing action of "Reviewed" or "Reviewed and Noted" on the first submittal shall be resubmitted for review. A light fixture receiving a shop drawing action of "Resubmit" or "Rejected" after the third review for any reason, shall be furnished as originally specified.
3. The portfolios shall be made from standard manufacturer's specification sheets. Each fixture shall be identified by the letter or number indicated on the fixture schedule. The combining of more than one fixture type of fixture on a single sheet shall not be acceptable.

2. PRODUCTS

- 2.1 Manufacturer: Manufacturers of lighting fixtures are noted on the drawings by notes and/or by the light fixture schedule.
- 2.2 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.
- 2.3 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.

2.4 LED's

- 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 as shown in the light fixture schedule. 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.

2.5 PLASTER FRAMES

- A. Standard plaster frames shall be provided for all recessed lighting fixtures installed in plaster or drywall finished walls or ceilings. Coordinate with architectural drawings.

3. EXECUTION

3.1 INSTALLATION

- A. Install lighting fixtures at locations and heights as indicated, 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 lighting fixtures fulfill requirements.

- B. Coordinate with other electrical work as appropriate to properly interface installation of lighting fixtures with other work.
- C. Adjust and Clean: Clean lighting fixtures of dirt and debris upon completion of the installation. Protect installed fixtures from damage during the remainder of the construction period.
- D. Field Quality Control: 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.
- E. 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):
 - 1. 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.
 - 2. 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.
- F. Square and rectangular fixtures shall be mounted with sides parallel to building and ceiling lines, unless otherwise noted.
- G. Where special fixtures to be used in special ceilings are scheduled, verify all ceiling system details and coordinate fixture type and accessories prior to ordering fixtures. Coordinate and cooperate with ceiling system supplier in the preparation of ceiling system shop drawings.

END OF SECTION 26 51 00

SECTION 28 31 11 – ADDRESSABLE FIRE ALARM SYSTEM

1. GENERAL

1.1 SUMMARY

- A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
 - 1. Fire alarm and detection operations
 - 2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, fire suppression systems, and other equipment as indicated in the drawings and specifications.
 - 3. One-way supervised automatic voice alarm operations.

1.2 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide alternate products by one of the following:
 - 1. Notifier
 - 2. Honeywell
 - 3. Siemens Fire Technology
- B. The Manufacturer shall be a nationally recognized company specializing in fire alarm and detection systems. This organization shall employ factory trained and NICET certified technicians, and shall maintain a service organization within 100 miles of this project location. The Manufacturer and service organization shall have a minimum of 10 years experience in the fire protective signaling systems industry.
- C. Being listed as an acceptable Manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications.

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following divisions apply:
 - 1. Division 23: "HVAC"
 - 2. Division 26: "Electrical"
- C. The system and all associated operations shall be in accordance with the following:
 - 1. Guidelines of the following Building Code: IBC
 - 2. IFC

3. NFPA 72, National Fire Alarm Code
4. NFPA 70, National Electrical Code
5. NFPA 101, Life Safety Code
6. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
7. Other applicable NFPA standards
8. Local Jurisdictional Adopted Codes and Standards
9. ADA Accessibility Guidelines

1.4 SYSTEM DESCRIPTION

- A. General: Provide a complete, non-coded, addressable, microprocessor-based, horn-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.
- B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.
- C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.
- D. Recording of Events: During installation and testing record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications
- E. Wiring/Signal Transmission:
 1. Transmission shall be hard-wired, using separate individual circuits for addressable signal transmission, dedicated to fire alarm service only].
 2. System connections for initiating SLC circuits and notification appliance circuits.
 3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.
- F. Remote Access:
 1. FACP shall be capable of providing Remote Access through a network connection (without additional software or hardware) using the public switched telephone system of a private switched telephone system.
 2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.
 3. FACP shall be capable of providing Remote Access (without additional software or hardware) through a listed Internet Interface via a standard web browser user interface.
- G. Required Functions: The following are required system functions and operating features:
 1. Priority of Signals: Fire Alarm events have the highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority

- respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
2. Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent activations.
 3. Automatically route alarm, supervisory, and trouble signals to an Owner designated location (remote central station). Fully coordinate requirements with the Owner and the Division 21 contractor..
 4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP, indicating the location and type of device.
 5. General Alarm: A system general alarm shall include:
 - a. Indication of alarm condition at the FACP.
 - b. Identification of the device that is the source of the alarm at the FACP.
 - c. Operation of audible and visible notification devices throughout the building until silenced at FACP.
 - d. Closing doors normally held open by magnetic door holders.
 - e. Unlocking designated doors.
 - f. Shutting down building supply and return fans when alarm is initiated.
 - g. Closing smoke dampers in building when alarm is initiated.
 - h. Notifying the local fire department.
 6. Supervisory Operations: Upon activation of a supervisory device the system shall operate as follows:
 - a. Activate the system supervisory service audible signal and illuminate the LED at the control unit.
 - b. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
 - c. Record the event in the FACP historical log.
 - d. Transmission of supervisory signal to an Owner designated remote central station.
 - e. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.
 7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation while strobes continue to alarm.
 8. System Reset
 - a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
 - b. Should an alarm condition continue, the system will remain in an alarmed state.
 9. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
 10. WALKTEST: The system shall have the capacity of 8 programmable pass-code protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
 - a. The city circuit connection shall be bypassed for the testing group.

- b. Control relay functions associated to one of the 8 testing groups shall be bypassed.
- c. The control unit shall indicate a trouble condition.
- d. The alarm activation of any initiation device in the testing group shall cause the audible notification appliances to sound to identify the device or zone.
- e. The unit shall automatically reset itself after signaling is complete.
- f. Any momentary opening of initiating or notification appliance circuit wiring shall cause the audible signals to voice announce the trouble condition.

H. Analog Smoke Sensors:

- 1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
- 2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
- 3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
- 4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a video display or printed for annual recording and logging of the calibration maintenance schedule.
- 5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to indicate that a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate that a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a dirty sensor without creating a trouble in the system. If this indicator is ignored, a second level "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported to the Central Monitoring Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
- 6. The FACP shall continuously perform an automatic self-test on each sensor which will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
- 7. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
- 8. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

I. Smoke Detectors: A maintenance and testing service providing the following shall be included with the base bid:

- 1. Biannual sensitivity reading and logging for each smoke sensor.
- 2. Scheduled biannual threshold adjustments to maintain proper sensitivity for each smoke sensor.
- 3. Threshold adjustment to any smoke sensor that has alarmed the system without the presence of particles of combustion.
- 4. Scheduled biannual cleaning or replacement of each smoke detector or sensor within the system.
- 5. Semi-annual functional testing of each smoke detector or sensor using the manufacturer's calibrated test tool.

6. Written documentation of all testing, cleaning, replacing, threshold adjustment, and sensitivity reading for each smoke detector or sensor device within the system.
 7. The initial service included in the bid price shall provide the above listed procedures for a period of five years after owner acceptance of the system.
- J. Audible Alarm Notification: By tone signals on horns in areas as indicated on drawings.
- K. Visual Alarm Notification: By flash tube signals on fire alarm strobe devices in areas as indicated on drawings.
- L. Fire Suppression Monitoring:
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
 2. Sprinkler/Stand Pipe valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
 3. WSO: Water flow switch and sprinkler/stand pipe valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.
- M. Power Requirements
1. The control unit shall receive AC power via a dedicated branch circuit.
 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in accordance with code requirements. All battery charging and recharging operations shall be automatic.
 3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.
 4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously while incoming power is present.
 5. The system batteries shall be supervised so that a low battery or depleted battery condition or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
 6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control
 7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
 8. All notification circuits shall have a minimum of 20% spare current draw capacity for future devices. At a minimum, each floor shall be on its own circuit. Provide additional circuits per floor as required to accommodate actual number of devices shown on plan.
 9. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.5 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
 2. Wiring diagrams from manufacturer.

3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of annunciator. All notification circuits shall have a minimum of 20% spare current draw capacity for future devices.
 4. Shop drawings showing system details including location of FACP, all devices, circuiting and details of annunciator.
 5. System Power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
 6. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, NAC, relay, sensor, and auxiliary control circuits.
 7. Operating instructions for FACP.
 8. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
 9. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
 10. Record of field tests of system.
- B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions if required to make clarifications or revisions to obtain approval.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A factory authorized installer is to perform the work of this section.
- B. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.7 MAINTENANCE SERVICE

- A. Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.
- B. Basic Services: Systematic, routine maintenance visits on a quarterly basis at times scheduled with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.
- C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.
- D. Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the maintenance services contract, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. Owner will be under no obligation to accept maintenance service contract renewal proposal.

1.8 EXTRA MATERIALS

- A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:
1. Break Rods for Manual Stations: Furnish quantity equal to 15 percent of the number of manual stations installed; minimum of 6 rods.
 2. Strobe Units: Furnish quantity equal to 10 percent of the number of units installed, but not less than one.
 3. Smoke Detectors or Sensors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of the number of units of each type installed but not less than one of each type.
 4. Detector or Sensor Bases: Furnish quantity equal to 2 percent of the number of units of each type installed but not less than one of each type.

2. PRODUCTS

2.1 FIRE ALARM CONTROL PANEL (FACP)

- A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."
- B. The following FACP hardware shall be provided:
1. Power Limited base panel with red cabinet and door, 120 VAC input power.
 2. Point capacity equal to a minimum of 150% of the points required by the plans, where (1) point equals (1) monitor (input) or (1) control (output).
 3. Point capacity equal to a minimum of 150% of points required by the plans, of Network Annunciation at FACP Display when applied as a Network Node
 4. Point capacity equal to a minimum of 150% of points required by the plans, of annunciation where one (1) point of annunciation equals:
 - a. 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
 - b. 1 LED on panel or 1 switch on panel.
 5. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FCP LCD Display.
 6. Municipal City Circuit Connection with Disconnect switch, 24VDC Remote Station (reverse polarity), local energy, shunt master box, or a form "C" contact output.
 7. One Auxiliary electronically re-settable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
 8. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
 9. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries.
 10. Power Supplies with integral intelligent Notification Appliance Circuit Class B for system expansion.
 11. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.
 12. The FACP shall support (4) RS-232-C ports and one service port.
 13. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
 14. Programmable DACT for Point Reporting.

15. Service Port Modem for dial in pass-code access to all fire control panel information.
- C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.
- D. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
- E. Distributed Module Operation: FACP shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 4 (Class B) supervised serial communications channel (SLC):
 1. Addressable Signaling Line Circuits
 2. Initiating Device Circuits
 3. Notification Appliance Circuits
 4. Auxiliary Control Circuits
 5. Annunciator LED/Switch Control Modules

2.2 REMOTE LCD ANNUNCIATOR

- A. Provide a remote LCD annunciator with the same "look and feel" as the FACP operator interface. The remote LCD annunciator shall use the same Primary Acknowledge, Silence and Reset Keys, Status LEDs and LCD Display as the FACP.
- B. Annunciator shall have super-twist LCD display with two lines of 40 characters each. Annunciator shall be provided with four (4) programmable control switches and associated LEDs.
- C. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.
- D. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- E. The LCD shall display the following information relative to abnormal condition of a point in the system:
 1. 40 character custom location label.
 2. Type of device (e.g. smoke, pullstation, water flow).
 3. Point status (e.g., alarm, trouble).
- F. Operator keys shall be key switch enabled to prevent unauthorized use. They key shall only be removable in the disabled position.
- G. Acknowledge, Silence and Reset operations shall be the same as the FACP

2.3 REMOTE PC ANNUNCIATOR

- A. Fire Alarm Control Unit shall be capable of operating remote monitors and/or printers; output shall be ASCII from an RS-232-C connection with an adjustable baud rate.

- B. Fire Alarm Control Unit shall be capable, without the additional of hardware or software, of operating a PC Annunciator which provides status annunciation and limited system control using a convenient and familiar Microsoft Windows® operating system based interface. PC Annunciator shall provide the following functions:
 - 1. Login/logout password protection with time duration selectable automatic logout
 - 2. Displays Alarm, Supervisory, Priority 2, and Trouble conditions with numerical tallies for each
 - 3. Displays first and last alarms
 - 4. Different event types have separate visible indicators with a common audible indicator
 - 5. Event logs can be searched and printed
 - 6. View and/or print status reports and service reports (printing requires an available local or network printer)
 - 7. Alarm Silence; System Reset; and Priority 2 Reset
 - 8. Global and individual point acknowledge
 - 9. Set system time and date; and clear event log
 - 10. Individual point access for control or parameter revisions
- C. Each RS-232-C port shall be capable of supporting and supervising a remote Printer; the FACP shall support as many as two (2) remote displays. The Fire Alarm Control Panel shall support five (5) RS-232-C ports.

2.4 EMERGENCY POWER SUPPLY

- A. General: Components include battery, charger, and an automatic transfer switch.
- B. Battery: Sealed lead-acid. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of time in accordance with code requirements and as follows:
 - 1. Batteries must be capable of operating the system in normal mode for 24 hours with sufficient capacity to operate the panel in alarm mode for 15 minutes at the end of that 24 hour period.
- C. Battery size shall be a minimum of 125% of the calculated size.

2.5 ADDRESSABLE MANUAL PULL STATIONS

- A. Description: Addressable single-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.
- B. Protective Shield: Provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

2.6 ADDRESSABLE SMOKE SENSORS

- A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
 - 1. Factory Nameplate: Serial number and type identification.
 - 2. Operating Voltage: 24 VDC, nominal.

3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
 4. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
 5. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit. In alarm condition, the sensor base LED shall be on steady.
 6. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
 7. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
 8. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
 9. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP.
- B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type. Where acceptable per manufacturer specifications, ionization type sensors may be used.
- C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.
- D. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. In ducts with air-duct velocities lower than 100 feet per minute (transfer ducts, large air plenums, etc.) the detector shall have an air-duct velocity range of 0-3000 feet per minute. Coordinate all air velocity ranges with the Division 23 Contractor. Sensor includes relay as required for fan shutdown.
1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
 2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
 3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
 4. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
 5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
 6. Housing shall provide a magnetic test area and Red sensor status LED.
 7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
 8. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.
 9. Where indicated a NEMA 4X weatherproof duct housing enclosure shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.
 10. Detector shall have dry contacts for connection to BMS system.

2.7 ADDRESSABLE HEAT SENSORS

- A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
- B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.
- C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
- D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.8 ADDRESSABLE CIRCUIT INTERFACE MODULES

- A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems.
- B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required. The two-wire signaling line circuit shall supply power and communications to the module.
- C. There shall be the following types of modules:
 - 1. Type 1: Monitor Circuit Interface Module:
 - a. For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
 - b. For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
 - 2. Type 2: Monitor Circuit Interface Module
 - a. This type of module is an individually addressable module that has both its power and its communications supplied by the two wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
 - b. This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short).
 - 3. Type 3: Single Address Multi-Point Interface Modules

- a. This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.
 - b. This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 - c. This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.
4. Type 4: Control Circuit Interface Module
- a. This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.
5. Type 5: 4-20 mA Analog Monitor Circuit Interface Module
- a. This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.

- D. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.9 MAGNETIC DOOR HOLDERS

- A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develops a minimum of 25 lbs. holding force.
- B. Material and Finish: Match door hardware.

2.10 ALARM NOTIFICATION APPLIANCES (**White in Color**)

- A. Notification Appliances: The Contractor shall furnish and install Notification Appliances and accessories to operate on compatible signaling line circuits (SLC).
 - 1. Notification appliance operation shall provide power, supervision and separate control of horns and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance

operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.

2. Class B (Style 4) notification appliances shall be wired without requiring traditional in/out wiring methods; addressable "T" Tapping shall be permitted. Up to 63 appliances can be supported on a single channel.
 3. Each notification appliance shall contain an electronic module. This on-board module shall allow the channel to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications.
- B. Audible: Horn shall be listed to UL 464. Horn appliances shall have a High/Lo Setting, programmable by channel from the controller or by appliance from the host FACP. The horn shall have a minimum sound pressure level of 83 or 89 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot.
- C. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.
- D. Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 83 or 89 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The appliance shall be capable of two-wire synchronization with one of the following options:
1. Synchronized Strobe with Horn on steady
 2. Synchronized Strobe with Temporal Code Pattern on Horn
 3. Synchronized Strobe with March Time cadence on Horn
 4. Synchronized Strobe firing to NAC sync signal with Horn silenced
- E. Isolator Module: Isolator module provides short circuit isolation for notification appliance SLC wiring. Isolator shall be listed to UL 864. The Isolator shall mount directly to a minimum 2 1/8" deep, standard 4" square electrical box, without the use of special adapter or trim rings. Power and communications shall be supplied by the Controller channel SLC; dual port design shall accept communications and power from either port and shall automatically isolate one port from the other when a short circuit occurs. The following functionality shall be included in the Isolator module:
1. Report faults to the host FACP.
 2. On-board Yellow LED provides module status.
 3. After the wiring fault is repaired, the Isolator modules shall test the lines and automatically restore the connection.
- F. Accessories: The contractor shall furnish the necessary accessories.
- 2.11 NAC Power Extender

- A. The Controller shall be a stand-alone panel capable of powering a minimum of 3 Signaling line circuits. Each channel shall be rated for 2.5 amps and support up to 63 notification appliances. Power and communication for the notification appliances shall be provided on the same pair of wires.
- B. SLC notification appliance circuits shall be Class B Style 4.
- C. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.
- D. The NAC extender panel may be mounted close to the host control panel or can be remotely located.

3. EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.
- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
 - 1. Factory trained and certified personnel.
 - 2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
 - 3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.
- B. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler/stand pipe valve required to be supervised.
- C. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

3.3 WIRING INSTALLATION

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
- B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

- C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.
- D. Install all fire alarm system wiring in RED conduit.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
 - 1. Factory trained and certified.
 - 2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
 - 3. International Municipal Signal Association (IMSA) fire alarm certified.
 - 4. Certified by a state or local authority.
 - 5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.
- E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.
- H. Final Test, Certificate of Completion, and Certificate of Occupancy:
 - 1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

3.5 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.6 TRAINING

- A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
 - 1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
 - 2. Schedule training with the Owner at least seven days in advance.

END OF SECTION 28 31 11

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. See Section 007300 "Supplementary Conditions", if included, for requirements relating to interpretation of the drawings and specifications.
 - 2. See Section 012100 "Allowances", if included, for use of allowances and what may and may not be included in them.

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 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.

1.4 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 geotechnical report.
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 311000

SECTION 31 20 00 - EARTH MOVING

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. See Section 007213 "General Conditions", if included, for requirements relating to interpretation of the drawings and specifications.
 - 2. See Section 012100 "Allowances", if included, for use of allowances and what may and may not be included in them.

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

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
- C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

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, 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. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. 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. Notify Geotechnical Engineer when excavations have reached required subgrade.
- B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- D. 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. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete"

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. 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.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. 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 building slabs, use engineered fill.
5. 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 329200 – 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. See Section 007213 “General Conditions”, if included, for requirements relating to interpretation of the drawings and specifications.
 - 2. See Section 012100 “Allowances”, if included, for use of allowances and what may and may not be included in them.

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. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of manicured turf grass and native meadow grass during a calendar year. Submit before expiration of required initial maintenance periods.
- 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. 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 or 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. Spring Planting: May 15-June 30 for cool and warm season grasses.
2. Fall planting: September 1-October 15 for cool season grasses only and dormant planting is to be November 1-December 15. Seeding operations shall occur immediately after preparation of bed during this season only, except when prior written permission is obtained from the Architect.
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 MAINTENANCE SERVICE

1. Initial Turf Maintenance Service: Provide full maintenance for 1 year by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established.

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. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast-and slow-release nitrogen, 50 percent derived from natural organic sources or urea formaldehyde, phosphorous, and potassium in the following composition:
 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in 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. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil report from a qualified soil-testing laboratory.

2.3 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew-and seed free, salt hay or threshed strew of wheat, rye, oats, or barley.

- B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacture for slurry application; nontoxic and free of plant-growth or germination inhibitors.

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 adjacent and adjoining areas from hydroseeding and hydromulching overspray.
 - 2. 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 AREA PREPARATION

- A. Limit turf subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 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 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - 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. 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 spreader or seeding machine. 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. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 2. 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. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes where shown on Drawings; installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.
- F. Protect seeded areas with slopes not exceeding 1:3 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons /acre to form a continuous blanket 1 inch in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.5 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. 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.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water turf with fine spray at a minimum rate of 2 inch per week unless rainfall precipitation is adequate.
- C. Mow manicured turf grasses as soon as top growth is tall enough to cut. Repeat mowing to maintain a min 2.5 inch to 3 inch height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

3.6 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.7 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.

3.8 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.

END OF SECTION 329200

APPENDIX 1

ASBESTOS AND LEAD-BASED PAINT INSPECTION

Warrensburg Readiness Center
343 Gay Street, Warrensburg, MO 64093

Prepared For:



CLARK &
ENERSEN

Rick Wise

Director of Architecture, Director
of Construction Administration
Clark & Enersen
2020 Baltimore Ave, Suite 300
Kansas City, MO 64108

Date: March 29, 2023

Project Number: 923088

Prepared By:

OCCU-TEC, Inc.
2604 NE Industrial Drive, Suite 230
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Phone: (816) 231-5580
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Appendices

Appendix A – Inspector Qualifications

Appendix B – Asbestos Laboratory Analytical Results and Chain-of-Custody

Appendix C – Homogeneous Materials Table

Appendix D – Functional Space Sheet

Appendix E – XRF Analysis Results

EXECUTIVE SUMMARY

OCCU-TEC, Inc. (OCCU-TEC) completed an asbestos lead-based paint inspection of the subject property located at 343 Gay Street, in Warrensburg, MO 64093 at the request of Rick Wise at Clark & Enersen. The inspection was completed throughout the entirety of the building.

The inspection was completed by Justin Arnold of OCCU-TEC on March 7, 2023. The inspection was completed in general accordance with the requirements set forth by the United States Environmental Protection Agency (EPA) Asbestos Hazard Emergency Response Act (AHERA), the National Standards for Emissions of Hazardous Air Pollutants, Housing and Urban Development, Missouri Department of Health and Human Services, State of Missouri regulations, and local regulations as applicable.

During the inspection, OCCU-TEC identified eighteen (18) suspect asbestos containing materials (ACMs) that were quantified and sampled. Samples were analyzed by Polarized Light Microscopy by Hayes Microbial Consulting of Midlothian, Virginia. Samples are considered ACM if at least one sample from a homogenous material contains asbestos at a concentration greater than 1-percent by volume. Results of sampling indicated the presence of ACMs at the subject property.

This executive summary has been prepared to provide a brief outline of the activities completed during the investigation and a general overview of the results of the investigation. Additional detail regarding the methodology and results of the investigation are included the subsequent report. The report should be read in its entirety for a complete understanding of the investigation and results.

KEY TERMS AND ACRONYMS

EPA – United States Environmental Protection Agency

ASHERA – Asbestos Hazard and Emergency Response Act

NESHAP – National Emissions Standards for Hazardous Air Pollutants

MDNR – Missouri Department of Natural Resources

ACM – Asbestos Containing Material

PACM – Presumed Asbestos Containing Material

PLM – Polarized Light Microscopy

TEM – Transmission Electron Microscopy

NOB – Non-Organically Bound ACM

CAA – Clean Air Act

AIHA – American Industrial Hygiene Association

HUD – United States Department of Housing and Urban Development

LBP – Lead-based Paint

XRF – X-Ray Fluorescent Analyzer

1.0 INTRODUCTION

On March 7th, 2023, Mr. Justin Arnold of OCCU-TEC completed an asbestos and lead-based paint inspection of the subject property located at 343 East gay Street, Warrensburg, MO 64093. The inspection was completed at the request of Rick Wise of Clark & Enersen in response to scheduled renovations within the building.

2.0 METHODOLOGY

2.1 Asbestos Inspection

The asbestos inspection was completed in general accordance with generally accepted industry standards and the requirements set forth by the EPA procedures outlined in Title 40 Code of Federal Regulations Part 61 (40 CFR § 61) and the AHERA (40 CFR § 763). The Inspection was completed by an accredited inspector licensed by the state of Missouri. A copy of the inspector's credentials is included in Appendix A.

The inspection involved a systematic visual assessment of the subject property to identify suspect ACM. Suspect ACMs were grouped into Homogeneous Areas or Materials based on the type of material, color, texture and date of application/installation. Once homogeneous materials/areas are identified, each material is categorized into one of three categories: Surfacing Materials, Thermal System Insulation, or Miscellaneous Materials based on the definition outlined in the AHERA (40 CFR § 763).

After identification, materials are assessed to determine if the material is friable or non-friable. Friable is defined by the EPA as any identified ACM, that when dry, can be crumbled, pulverized or reduced to powder by hand pressure (40 CFR § 763). Materials determined to be non-friable will be classified as Category I non-friable or Category II non-friable. Category I non-friable ACM is defined by the EPA as "asbestos containing resilient floor coverings, asphalt roofing products, packings and gaskets. All other non-friable ACM that is not classified as Category I non-friable is considered Category II non-friable ACM (40 CFR § 61).

Bulk samples of suspect homogeneous ACMs were collected in accordance with the requirements set forth in 40 CFR § 763.86 based the following requirements:

- Surfacing materials: Random sampling using the "3-5-7 rule" for sampling each homogeneous area of surfacing material. (3 samples from material 1,000 square feet or less, 5 samples of material between 1,000 square feet and 5,000 square feet, and 7 samples from material greater than 5,000 square feet).

- Thermal system insulation: At least 3 samples, randomly distributed, from each homogeneous area.
- Miscellaneous material: Samples (minimum of 2) will be collected from each homogenous area of suspect miscellaneous ACM.

It should be noted that the quantity of samples collected may vary from the requirements listed above. If the quantity of samples collected from each homogeneous area varied from the requirements listed above, OCCU-TEC collected samples in accordance with the exceptions listed in 40 CFR § 763.86 subpart (b)(2) through (4).

All samples collected were submitted to Hayes Microbial Consulting (Hayes) of Midlothian, Virginia for laboratory analysis. The National Institute of Standards and Technology (NIST) accredits laboratories under the National Laboratory Accreditation Program (NVLAP). The NVLAP lab code number for Hayes is 500096-0. Bulk samples were analyzed by polarized light microscopy (PLM) using the dispersion staining technique as set forth in 40 CFR § 763 (E): *Interim Method for the Determination of Asbestos in Bulk Insulation Samples*.

A material is considered ACM if at least one sample collected from the homogenous area contained asbestos at a concentration greater than one percent (1%) by volume. (15 U.S.C Chapter 15 Subchapter II).

2.2 Lead-Based Paint

The Risk Assessment was conducted in accordance with Housing and Urban Development (HUD) 24 CFR Part 35, Environmental Protection Agency (EPA) 40 CFR Part 745, and all applicable state and local regulations. The Risk Assessment was conducted to determine the existence, nature, and severity of lead hazards through a visual inspection, lead x-ray fluorescence (XRF) testing and possibly lead wipe and lead soil sampling.

Visual Inspection and Testing Methodology

Upon arrival at the site, a visual inspection of the subject property was conducted to give an overview of the painting history, look for signs of deteriorated paint, assess the extent of deterioration, and look for any other potential lead hazards. Some windows in the structure would not open and could not be tested. Aluminum storm windows had been installed limiting access to some of the original wood exterior window components. Metal flashing had been installed over the exterior windowsills. Vinyl siding had also been installed over the transite siding limiting access.

After the visual inspection, lead-based paint testing by XRF methods was conducted. Wipe sampling, if conducted, was performed in locations where lead

was detected, or where paint was deteriorated, or visible dust was present, or near friction or impact spots. Soil sampling, if conducted, was performed in bare soil areas in children's play areas and around the dripline of the foundation.

XRF Paint Testing

XRF testing was conducted using Viken Detection Model Pb200i X-ray Florescence (XRF) detector, Serial # 01098, General License # 53-0720, utilizing a Cobalt - 57 radioisotope source with an activity level of 5 millicuries (mCi). XRF results are classified as positive if they are greater than or equal to the stated threshold for the instrument (1.0 mg/cm²), and *negative* if they are *less than* the threshold.

A minimum of three calibration check readings were taken, using a 1.0 mg/cm² calibration block, before beginning the inspection, after 4 hours, and at the end of testing for the day. RMD's HUD XRF Performance Characteristic Sheet, Edition 3, November 27, 1995, set the XRF Calibration Check Limits as 0.7 to 1.3 mg/cm². Additional calibration check readings were performed every four hours or after every individual building was completed. All calibration readings were within acceptable limits.

Housing and Urban Development (HUD) defines lead-based paint as any paint or other surface coating materials that contain lead equal to or in excess of 1.0 mg/cm² or more than five-tenths percent by weight. The lead testing data (Appendix D-1) will show all components that were tested, components that were tested at or above the HUD lead standard of 1.0 mg/cm² are indicated by bold type and highlighted. If there are components that were not tested, they too must be considered lead containing.

As demonstrated by the inspection reports (Appendix D-1), each assay is associated with a wall which is identified as either North, East, South, or West.

3.0 INVESTIGATION RESULTS

3.1 Asbestos Results

The materials listed below are either confirmed to contain asbestos above the Federal EPA level of greater than 1% asbestos content, are at trace (<1%) levels, or were assumed to contain asbestos. A material description, approximate quantities, and material locations of the ACM identified at the subject property have been summarized below. Quantities are only an approximation and should be verified by any asbestos abatement contractor who may submit future abatement bids.

Table 3.1 Summary of Asbestos Containing Materials

Sample #	Sample Description	Material Location	Quantity	Friability	% Asbestos
MJF-07-01, 02, 03	Mudded Joint Fittings	Room 8 & Drill Hall	**11 EA	Yes	60% Chrysotile
FTM-09-01, 02, 03	12" White Floor Tile with Gray Pattern & Mastic	Room 9 (Kitchen)	320 SF	No	2% Chrysotile

Chry. = Chrysotile
 Amo. = Amosite
 Croc. = Crocidolite
 Tri. = Tremolite

Sq.Ft. = Square Feet
 EA = Each
 w/ = With
 Rm. = Room

FR = Friable
 NFR=Non-Friable
 **Possibly above plaster ceilings in other rooms as well

3.2 Lead-Based Paint Results

All materials listed below contain lead above the HUD and the State of Missouri standard. A material description and material locations of the lead-based paint identified at the Subject Property have been summarized below. It should be noted that samples taken at the site are representative of the material samples. For the purposes of this investigation, any material exhibiting the characteristics identified in the below table should be considered positive for lead-based paint until further sampling can definitively prove otherwise.

Table 3.2 Lead-Based Paint Results Summary

XRF Reading #	Material	Material Location	Material Description	Reading (mg/cm ²)
342, 251, 359	Ceramic Wall Tile	Men's & Women's Restroom	Gray Ceramic Wall	2.5

mg/cm² = milligrams per cubic centimeter

4.0 HAZARDOUS MATERIALS INVENTORY

OCCU-TEC also conducted a hazardous materials inventory survey during the inspection. OCCU-TEC identified several materials that should be treated as hazardous, special, or universal waste prior to renovation of the structure. An inventory of the materials identified as requiring special handling is presented below.

Table 4.1 Household Hazardous Waste Inventory	
Item	Warrensburg Readiness Center
2 Bulb 4' Florescent Light Ballasts (1 Ballast ea.)	156
Emergency Exit Signs	6
Air Conditioning Units (IT)	*Present
Compressors	*Present
Refrigerant Canisters	*Present
HVAC Units (Roof Condensers)	*Present
<i>*Please note that AC compressors, refrigerant canisters, air conditioners, and HVAC Units are present in the building</i>	

5.0 LIMITATIONS OF THE INSPECTION

OCCU-TEC identified and collected samples of suspect ACM from the survey area of the Subject Property that were accessible at the time of the inspection. Every reasonable effort was made to access and identify all suspect ACM's. However, if materials are found that do not match materials sampled, they should be Presumed Asbestos Containing Materials (PACM), as defined in the OSHA Construction Standard for Asbestos 29 CFR 1926.1101, and treated as ACM until sampling and laboratory analysis meeting the OSHA requirements is conducted.

This report is provided for the sole reliance by Clark & Enersen. Any reliance by other parties is forbidden without OCCU-TECs express written consent. If other parties are granted reliance on this report by OCCU-TEC, said parties are bound by the terms and conditions set forth in the original proposal agreed to and signed by Clark Enersen.

6.0 RECOMMENDATIONS

OCCU-TEC recommends having any asbestos containing materials abated by a licensed contractor prior to any renovations that will impact ACMs. OCCU-TEC recommends using safe lead work practices as outlined by the Housing and Urban Development Title 24 CFR Part 35, Subpart B, Section 1350. Additionally, OCCU-TEC recommends following all Missouri regulations found in Rules of Department of Health, Division 30-Division of Health Standards and Licensure or other state requirements as applicable.

7.0 SIGNATURE(S)

OCCU-TEC appreciates the opportunity to provide Clark & Enersen with the above-referenced professional services. IF you have any questions regarding the contents of this report, please contact us at (816) 231-5580. Thank you for choosing OCCU-TEC.

Respectfully,



Justin Arnold, CIEC
Project Manager



Kevin Heriford
Director of EH&S

8.0 REFERENCES

-*The Asbestos Hazard Emergency Response Act (AHERA)* – 15 U.S.C Chapter 53, Subchapter II (1986)

-*Clean Air Act: National Emissions Standards for Hazardous Air Pollutants (NESHAP)*- 42 U.S.C § 7401 Section 112 (1970)

Missouri Air Conservation Law – 40 RSMo Chapter 643 parts 643.225-643.250

-*Interim Method for the Determination of Asbestos in Bulk Insulation Sample* - 40 CFR § 763 (E)

-*Asbestos General Standard* – OSHA – 29 CFR § 1910.1001

-*Asbestos Construction Standard* – OSHA – 29 CFR § 1926.1101

Communicable Disease Preventions Chapter 9 – Lead Program – State of Missouri – 19 CSR § 20-8.010 – 8.030

APPENDIX A
INSPECTOR QUALIFICATIONS

STATE OF MISSOURI
DEPARTMENT OF HEALTH AND SENIOR SERVICES

LEAD OCCUPATION LICENSE REGISTRATION

Issued to:

Justin E. Arnold

The person, firm or corporation whose name appears on this certificate has fulfilled the requirements for licensure as set forth in the Missouri Revised Statutes 701.300-701.338, as long as not suspended or revoked, and is hereby authorized to engage in the activity listed below.

Lead Risk Assessor
Category of License

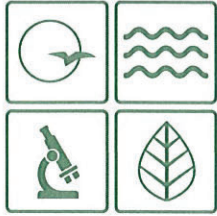
Issuance Date: **6/11/2022**
Expiration Date: **6/11/2024**
License Number: **120611-300003622**



Paula F. Nickelson

Paula F. Nickelson
Acting Director
Department of Health and Senior Services

Lead Licensing Program, PO Box 570, Jefferson City, MO 65102



Missouri Department of dnr.mo.gov

NATURAL RESOURCES

Michael L. Parson, Governor

Dru Buntin, Director

April 20, 2022

Justin E. Arnold
2604 NE Industrial Dr. Ste 230
North Kansas City, MO 64117

RE: Missouri Asbestos Occupation Certification Card

Enclosed is your certification card for Asbestos Inspector, as issued by the Asbestos Unit of the Missouri Department of Natural Resources' Air Pollution Control Program.

Missouri Certification Number: 7011041322MOIR13670

Course Training Date: April 13, 2022

Missouri Certification Approval Date: April 20, 2022

Missouri Certification Expiration Date: April 20, 2023

Note:

- All Missouri-certified asbestos personnel must comply with the following statutes and regulations:
 - Sections 643.225 to 643.250, RSMo;
 - 10 CSR 10-6.241 *Asbestos Projects-Registration, Abatement, Notification, Inspection, Demolition, and Performance Requirements; and*
 - 10 CSR 10-6.250 *Asbestos Projects-Certification, Accreditation and Business Exemption Requirements.*
- To keep your occupation certification up-to-date, you must complete an annual refresher course and submit a renewal application each year.
- In order to be eligible to renew your certification, you must successfully complete a refresher course with a Missouri-accredited training provider within 12 months of the expiration date of your current training certificate. If you exceed this grace period, you will be required to retake a Missouri-accredited initial course in order to be eligible for Missouri certification.

To obtain a copy of the certification renewal application, or review regulations and requirements, please visit our website at <http://dnr.mo.gov/env/apcp/asbestos/index.htm>.

If you have any questions please call the Air Pollution Control Program at 573-751-4817.

AIR POLLUTION CONTROL PROGRAM

Director of Air Pollution Control Program



APPENDIX B
**ASBESTOS LABORATORY ANALYTICAL RESULTS AND CHAIN-OF-
CUSTODY**



#23009938

Analysis Report prepared for

Occu-Tec

2604 NE Industrial Drive
Suite 230
North Kansas City, MO 64117

Phone: (816) 994-3420

923088
Warrensburg Readiness Center

Collected: **March 6, 2023**
Received: **March 8, 2023**
Reported: **March 15, 2023**



EPA Laboratory ID: VA01419

We would like to thank you for trusting Hayes Microbial for your analytical needs!
We received 40 samples by FedEx in good condition for this project on March 8th, 2023.

The results in this analysis pertain only to this job, collected on the stated date, and should not be used in the interpretation of any other job. Information supplied by the customer can affect the validity of results. These results apply only to the samples as received. This report may not be duplicated, except in full, without the written consent of Hayes Microbial Consulting, LLC.

All information provided to Hayes Microbial is confidential information relating to our customers and their clients. We will not disclose, copy, or distribute any information verbally or written, except to those designated by the customer(s). We take confidentiality very seriously. No changes to the distribution list will be made without the express consent of the customer.

This laboratory bears no responsibility for sample collection activities, analytical method limitations, or your use of the test results. Interpretation and use of test results are your responsibility. Any reference to health effects or interpretation of mold levels is strictly the opinion of Hayes Microbial. In no event, shall Hayes Microbial or any of its employees be liable for lost profits or any special, incidental or consequential damages arising out of the use of these test results.

Steve Hayes, BSMT (ASCP)
Laboratory Director
Hayes Microbial Consulting, LLC.



Lab ID: #188863



DPH License: #PH-0198

#	Sample	Material Description	Non-Asbestos Fibers	Asbestos Fibers
1	DWJC-01-01 - Drywall & Joint Compound	Drywall / Off-white/Brown Joint Compound / White	10% Cellulose Fibers	None Detected
2	DWJC-01-02 - Drywall & Joint Compound	Drywall / White/Brown Joint Compound / White	10% Cellulose Fibers 2% Fiberglass	None Detected
3	DWJC-01-03 - Drywall & Joint Compound	Drywall / Off-white/Brown Joint Compound / White	10% Cellulose Fibers	None Detected
4	CBA-02-01 - 4" Gray Cove Base & Adhesive	Cove Base / Gray Adhesive / Cream		None Detected
5	CBA-02-02 - 4" Gray Cove Base & Adhesive	Cove Base / Gray Adhesive / Cream Adhesive / Yellow		None Detected
6	CF03-01 - 4x2 Ceiling Tile W Scatter Pattern Fissures	Ceiling Tile / White/Beige	50% Fiberglass 35% Cellulose Fibers	None Detected
7	CF03-02 - 4x2 Ceiling Tile W Scatter Pattern Fissures	Ceiling Tile / White/Beige	50% Fiberglass 35% Cellulose Fibers	None Detected

Collected: **Mar 6, 2023**

Received: **Mar 8, 2023**

Reported: **Mar 15, 2023**



Project Analyst:
Samuel Settle

Date:
03 - 15 - 2023

Reviewed By:
Brian Keith

Date:
03 - 15 - 2023

3005 East Boundary Terrace, Suite F. Midlothian, VA. 23112

(804) 562-3435

contact@hayesmicrobial.com

#	Sample	Material Description	Non-Asbestos Fibers	Asbestos Fibers
8	CF03-03 - 4x2 Ceiling Tile W Scatter Pattern Fissures	Ceiling Tile / White/Beige	50% Fiberglass 35% Cellulose Fibers	None Detected
9	CF04-01 - 4x2 Ceiling Tile W Width Wide Fissures	Ceiling Tile / White/Beige	45% Cellulose Fibers 35% Fiberglass	None Detected
10	CF04-02 - 4x2 Ceiling Tile W Width Wide Fissures	Ceiling Tile / White/Gray	45% Cellulose Fibers 25% Fiberglass	None Detected
11	CF04-03 - 4x2 Ceiling Tile W Width Wide Fissures	Ceiling Tile / White/Gray	45% Cellulose Fibers 25% Fiberglass	None Detected
12	CF05-01 - 4x2 Ceiling Tile - Poc & Pin Hole	Ceiling Tile / White/Beige	45% Cellulose Fibers 15% Fiberglass	None Detected
13	CF05-02 - 4x2 Ceiling Tile - Poc & Pin Hole	Ceiling Tile / White/Beige	45% Cellulose Fibers 15% Fiberglass	None Detected
14	CF05-03 - 4x2 Ceiling Tile - Poc & Pin Hole	Ceiling Tile / White/Beige	45% Cellulose Fibers 15% Fiberglass	None Detected
15	CM-06-01 - Carpet Mastic	Adhesive / Yellow		None Detected
16	CM-06-02 - Carpet Mastic	Adhesive / Yellow		None Detected
17	MJF-07-01 - Mudded Joint Fitting	Bulk Material / Gray		60% Chrysotile
18	MJF-07-02 - Mudded Joint Fitting	Fibrous / Off-White Bulk Material / Beige	65% Cellulose Fibers 80% Fiberglass	None Detected

Collected: **Mar 6, 2023**

Received: **Mar 8, 2023**

Reported: **Mar 15, 2023**



Project Analyst: *Samuel Settle*
Samuel Settle

Date: **03 - 15 - 2023**

Reviewed By: *Brian Keith*
Brian Keith

Date: **03 - 15 - 2023**

3005 East Boundary Terrace, Suite F. Midlothian, VA. 23112

(804) 562-3435

contact@hayesmicrobial.com

#	Sample	Material Description	Non-Asbestos Fibers	Asbestos Fibers
19	MJF-07-03 - Mudded Joint Fitting	Bulk Material / Beige	80% Fiberglass	None Detected
20	WTI-08-01 - Water Tank Insulation Wrap	Insulation / Yellow Wrap / White	95% Fiberglass 55% Cellulose Fibers	None Detected None Detected
21	WTI-08-02 - Water Tank Insulation Wrap	Fibrous / Off-White Fibrous / Yellow	85% Fiberglass 95% Fiberglass	None Detected None Detected
22	WTI-08-03 - Water Tank Insulation Wrap	Wrap / White Insulation / Yellow	65% Cellulose Fibers 95% Fiberglass	None Detected None Detected
23	FTM-09-01 - 12" White FT W Gray Pattern	Wrap / White Floor Tile / White	65% Cellulose Fibers	None Detected
24	FTM-09-02 - 12" White FT W Gray Pattern	Mastic / Black Floor Tile / White		2% Chrysotile None Detected
25	CBA-10-01 - 4" Black Cove Base & Adhesive	Mastic / Black Adhesive / Clear/Cream Cove Base / Black Adhesive / Brown		(Not Analyzed, Positive Stop) None Detected None Detected None Detected

Collected: **Mar 6, 2023**

Received: **Mar 8, 2023**

Reported: **Mar 15, 2023**



Project Analyst: *Samuel Settle*
Samuel Settle

Date: **03 - 15 - 2023**

Reviewed By: *Brian Keith*
Brian Keith

Date: **03 - 15 - 2023**

3005 East Boundary Terrace, Suite F. Midlothian, VA. 23112

(804) 562-3435

contact@hayesmicrobial.com

#	Sample	Material Description	Non-Asbestos Fibers	Asbestos Fibers
26	CBA-10-02 - 4" Black Cove Base & Adhesive	Cove Base / Black Adhesive / Brown		None Detected
27	FTM-11-01 - 12" Gray FT W White & Gray Pattern	Floor Tile / Gray Adhesive / Yellow		None Detected
28	FTM-11-02 - 12" Gray FT W White & Gray Pattern	Floor Tile / Gray Adhesive / Yellow		None Detected
29	CTF-12-01 - 2x4 Cream Ceiling Tile W Width Wide Fissures	Ceiling Tile / White/Beige	45% Fiberglass 35% Cellulose Fibers	None Detected
30	CTF-12-02 - 2x4 Cream Ceiling Tile W Width Wide Fissures	Ceiling Tile / White/Beige	45% Fiberglass 35% Cellulose Fibers	None Detected
31	CTF-12-03 - 2x4 Cream Ceiling Tile W Width Wide Fissures	Ceiling Tile / White/Beige	45% Fiberglass 35% Cellulose Fibers	None Detected
32	Stuc-13-1 - Stucco Exterior	Cementitious / Gray/Cream	10% Fiberglass	None Detected
33	Stuc-15-02 - Stucco Exterior	Cementitious / Gray/Cream	10% Fiberglass	None Detected
34	Stuc-15-03 - Stucco Exterior	Cementitious / Gray/Cream	10% Fiberglass	None Detected
35	Exp-16-01 - Expansion Joint Caulk	Caulk / Tan		None Detected
36	Exp-16-02 - Expansion Joint Caulk	Caulk / Tan		None Detected

Collected: **Mar 6, 2023**

Received: **Mar 8, 2023**

Reported: **Mar 15, 2023**



Project Analyst: *Samuel Settle*
Samuel Settle

Date: **03 - 15 - 2023**

Reviewed By: *Brian Keith*
Brian Keith

Date: **03 - 15 - 2023**

3005 East Boundary Terrace, Suite F. Midlothian, VA. 23112

(804) 562-3435

contact@hayesmicrobial.com

#	Sample	Material Description	Non-Asbestos Fibers	Asbestos Fibers
37	GWC-17-01 - Gray Window Caulk	Caulk / Gray		None Detected
38	GWC-17-02 - Gray Window Caulk	Caulk / Gray		None Detected
39	BWC-18-01 - Black Window Caulk	Caulk / Black		None Detected
40	BWC-18-02 - Black Window Caulk	Caulk / Black		None Detected



Collected: **Mar 6, 2023**

Received: **Mar 8, 2023**

Reported: **Mar 15, 2023**

Project Analyst: *Samuel Settle*
Samuel Settle,

Date: **03 - 15 - 2023**

Reviewed By: *Brian Keith*
Brian Keith,

Date: **03 - 15 - 2023**

3005 East Boundary Terrace, Suite F. Midlothian, VA. 23112

(804) 562-3435

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Asbestos Analysis Information

Analysis Details	All samples were received in acceptable condition unless otherwise noted on the report. This report must not be used by the client to claim product certification, approval, or endorsement by AIHA, NIST, NVLAP, NY ELAP, or any agency. The results relate only to the items tested. Hayes Microbial Consulting reserves the right to dispose of all samples after a period of 60 days in compliance with state and federal guidelines.
PLM Analysis	All Polarized Light Microscopy (PLM) results include an inherent uncertainty of measurement associated with estimating percentages by PLM. Materials with interfering matrix, low asbestos content, or small fiber size may require additional analysis via TEM Analysis.
TEM Analysis	Analysis by TEM is capable of providing positive identification of asbestos type(s) and semi-quantitation of asbestos content.
Definitions	'None Detected' - Below the detected reporting limit of 1% unless point counting is performed, then the detected reporting limit is .25%.
New York ELAP	Per NY ELAP198.6 (NOB), TEM is the only reliable method to declare an NOB material as Non-Asbestos Containing. Any NY ELAP samples that are subcontracted to another laboratory will display the name and ELAP Lab Identification number in the report page heading of those samples. The original report provided to Hayes Microbial Consulting is available upon request.



Company: OCCU-TEC Inc.
 2604 NE Industrial Drive Suite 230
 Address: North Kansas City, MO 64117

SHIP: FEDEX - PAK 50
 DATE: 03-08-2023



8175 9171 2785



Job Number: 923088
 Collector: Justin Arnold
 Date Collected: 3/6/2023

Job Name: **Warrensburg Readiness Center**

Mobile: 816.810.3276
 Email: jarnold@occutec.com

Note:

#	Group	Number	Sample Name	Analysis Type	Turnaround	Turnaround Times					Stop (+)	
						3 Hour*	Same Day*	1 Day	2 Day	3 Day		5 Day
1		DWLC-01-01	Drywall + Joint Compound	EPA 600*	5 Day	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day	Yes
2		DWLC-01-02	↓	EPA 600	5 Day	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day	Yes
3		DWLC-01-03	↓	EPA 600	5 Day	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day	Yes
4		CBA-02-01	4" Gray Cove-base + Adhesive	EPA 600	5 Day	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day	Yes
5		CBA-02-02	↓	EPA 600	5 Day	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day	Yes
6		CT-03-01	4'x2' Ceiling tile w/ scuffier pattern fissures	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes
7		CT-03-02	↓	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes
8		CT-03-03	↓	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes
9		CT-04-01	4'x2' Ceiling Tile w/ width wide fissures	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes
10		CT-04-02	↓	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes
11		CT-04-03	↓	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes
12		CT-05-01	4'x2' Ceiling Tile - Poc + Pin hole	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes
13		CT-05-02	↓	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes
14		CT-05-03	↓	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes
15		CM-06-01	Carpet Mastic	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes
16		CM-06-02	↓	EPA 600	5 Day	-	Same Day	1 Day	2 Day	3 Day	5 Day	Yes

Released by: *Justin Arnold* Date: 3/7/2023 Received By: *KH* Date: 3/8/23

Hayes Microbial Consulting, LLC. 3005 East Boundary Terrace, Suite F, Midlothian, VA. 23112 (804) 562-3435 contact@hayesmicrobial.com

Form #20, Rev 3, March 23, 2019 Chain of Custody



Company: OCCU-TEC Inc.

Address: 2604 NE Industrial Drive Suite 230
North Kansas City, MO 64117

SHIP: FEDEX - PAK 50
DATE: 03-08-2023

N

8175 9171-2785



23009938

ASBESTOS



Job Name: Warrensburg Readiness Center

Job Number: 923088

Collector: Justin Arnold

Date Collected: 3/6/2023

Mobile: 816.810.3276

Email: jarnold@occutec.com

Note:

PLM	Analysis Type	Analysis Methods	Turnaround Times					Stop (+)
			3 Hour*	Same Day*	1 Day	2 Day	3 Day	
	Bulk	EPA 600*	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day
	Point Count	400 Point*, 1000 Point*	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day
	Vermiculite	EPA 600*, Cincinnati Method	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day
	Soil	EPA 600*, CARB 435	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day
TEM	Air	EPA AHERA, NIOSH 7402	-	Same Day	1 Day	2 Day	3 Day	5 Day
	Bulk	Chatfield	-	Same Day	1 Day	2 Day	3 Day	5 Day
	Wipe	ASTM D6480-05	-	Same Day	1 Day	2 Day	3 Day	5 Day
	Microvac	ASTM D5755-09	-	Same Day	1 Day	2 Day	3 Day	5 Day
PCM	Air	NIOSH 7400	3 Hour	Same Day	1 Day	2 Day	3 Day	5 Day
#	Group	Number	Sample Name	Analysis Type	Turnaround	Volume / Area	Stop (+)	
1		MUF-06-01	Mudded Joint Fitting	EPA 600	5 Day		Yes	
2		MUF-06-02	↓	EPA 600	5 Day		Yes	
3		MUF-06-03	↓	EPA 600	5 Day		Yes	
4		WTF-07-01	Water Tank Insulation Wrap	EPA 600	5 Day		Yes	
5		WTF-07-02	↓	EPA 600	5 Day		Yes	
6		WTF-07-03	↓	EPA 600	5 Day		Yes	
7		FTM-07-01	12" white floor tile with gray pattern	EPA 600	5 Day		Yes	
8		FTM-07-02	↓	EPA 600	5 Day		Yes	
9		CBA-10-01	4" Black Cove-base + Adhesive	EPA 600	5 Day		Yes	
10		CBA-10-02	↓	EPA 600	5 Day		Yes	
11		FTM-11-01	12" Gray floor tile w/ white + Gray pattern	EPA 600	5 Day		Yes	
12		FTM-11-02	↓	EPA 600	5 Day		Yes	
13		CT-12-01	2'x4' Green ceiling tile w/ width wide fissures	EPA 600	5 Day		Yes	
14		CT-12-02	↓	EPA 600	5 Day		Yes	
15		CT-12-03	↓	EPA 600	5 Day		Yes	
16		STUCC-13-01	Stucco Exterior	EPA 600	5 Day		Yes	

Released by: *[Signature]*

Date: 3/7/2023

Received By: KH

Date: 3/8/23



Company: OCCU-TEC Inc.

Address: 2604 NE Industrial Drive Suite 230

North Kansas City, MO 64117

SHIP: FEDEX - PAK 50
DATE: 03-08-2023

ASBESTOS



23009938

8175 9171 2785



Job Name: Warrensburg Readiness Center

Job Number: 923088

Collector: Justin Arnold

Date Collected: 3/6/2023

Mobile: 816.810.3276

Email: jarnold@occutec.com

Note:

PLM	Analysis Type	Analysis Methods	Turnaround Times					Stop (+)
			3 Hour*	Same Day*	1 Day	2 Day	3 Day	
	Bulk	EPA 600*	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day
	Point Count	400 Point*, 1000 Point*	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day
	Vermiculite	EPA 600*, Cincinnati Method	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day
	Soil	EPA 600*, CARB 435	3 Hour*	Same Day*	1 Day	2 Day	3 Day	5 Day
TEM	Air	EPA AHERA, NIOSH 7402	-	Same Day	1 Day	2 Day	3 Day	5 Day
	Bulk	Chatfield	-	Same Day	1 Day	2 Day	3 Day	5 Day
	Wipe	ASTM D6480-05	-	Same Day	1 Day	2 Day	3 Day	5 Day
	Microvac	ASTM D5755-09	-	Same Day	1 Day	2 Day	3 Day	5 Day
PCM	Air	NIOSH 7400	3 Hour	Same Day	1 Day	2 Day	3 Day	5 Day

#	Group	Number	Sample Name	Analysis Type	Turnaround	Volume / Area	Stop (+)
1		STUC-15-02	Stucco Exterior ↓	EPA 600	5 Day		Yes
2		STUC-15-03		EPA 600	5 Day		Yes
3		Exp-14-01	Expansion Joint Caulk ↓	EPA 600	5 Day		Yes
4		Exp-14-02		EPA 600	5 Day		Yes
5		GWC-17-01	Gray Window Caulk ↓	EPA 600	5 Day		Yes
6		GWC-17-02		EPA 600	5 Day		Yes
7		BWC-18-01	Black Window Caulk ↓	EPA 600	5 Day		Yes
8		BWC-18-02		EPA 600	5 Day		Yes
9				EPA 600	5 Day		Yes
10				EPA 600	5 Day		Yes
11				EPA 600	5 Day		Yes
12				EPA 600	5 Day		Yes
13				EPA 600	5 Day		Yes
14				EPA 600	5 Day		Yes
15				EPA 600	5 Day		Yes
16				EPA 600	5 Day		Yes

Released by: *[Signature]* Date: 3/7/2023 Received By: *[Signature]* Date: 3/8/23

APPENDIX C
HOMOGENEUOS MATERIALS

HOMOGENEOUS MATERIALS

Client: Clark & Enerson Project Number: 923088
Project: NESHAP ACM/LBP/ORM Inspection Date: 3/7/2023
Building: Missouri ANG - Readiness Center Inspector: J. Arnold

HM #	MATERIAL DESCRIPTION	MATERIAL TYPE	FRIABLE NON-FRIABLE	ASBESTOS-CONTAINING MATERIAL	TOTAL QUANTITY
01	Drywall & Joint Compound	Misc	Non-Friable	ND	
02	4" Gray cove-base and adhesive	Misc	Non-Friable	ND	
03	4' White Ceiling Tile - Scatter Pattern Fissures	Misc	Friable	ND	
04	4' White Ceiling Tile - Width Wide Fissures	Misc	Friable	ND	
05	4' Wite Ceiling Tile - Poc & Pin Hole	Misc	Friable	ND	
06	Carpet Mastic	Misc	Non-Friable	ND	
07	Mudded Joint Fittings	TSI	Friable	ACM	11
08	Water Heater Tank Wrap	TSI	Friable	ND	
09	12" White Floor Tile with Gray Pattern & Mastic	Misc	Non-Friable	ACM	320
10	4" Black Cove-base & Adhesive	Misc	Non-Friable	ND	
11	12" Gray Floor tile with white pattern	Misc	Non-Friable	ND	
12	4' X 2' Cream CT with width wide fissures	Misc	Friable	ND	
13	Vault Fire Door	Misc	Non-Friable	Assume 2	1
14	Roofing Materials	Misc	Non-Friable	Assume 2	
15	Stucco	Surf	Non-Friable	ND	
16	Expansion Joint Caulk	Misc	Non-Friable	ND	
17	Gray Window Caulking	Misc	Non-Friable	ND	
18	Black Window/Door Caulking	Misc	Non-Friable	ND	

LEGEND: ACM = Asbestos Containment Materials Assume 1 = Assumed ACM (inaccessible LF = LINEAR FEET C = Chrysotile
 ND = No Asbestos Detected Assume 2 = Assumed ACM (would SF = SQUARE FEET A = Amosite
 Surf = Surfacing destroy material integrity) CF = CUBIC FEET
 TSI = Thermal System Insulation TR = <1% ACM EA = Each
 Misc. = Miscellaneous

APPENDIX D
FUNCTIONAL SPACE SHEET



OCCU-TEC

Proven Ingenuity for People, Planet and Profits

2604 N.E. Industrial Drive, Suite 230
 North Kansas City, Missouri 64117
 Phone: 816-231-5580
 Fax: 816-231-5641
www.occutec.com

Client:	Clark & Enerson	Project Number:	923088
Facility / Address:	Missouri ANG - Readiness Center 343 East Gay Street, Warrensburg, MO 64093	Date(s):	3/7/2023

ASBESTOS INSPECTION FUNCTIONAL SPACES

FUNCTIONAL SPACE NAME	FUNC. SPACE #	FLOOR	HM #	MAT. TYPE	MATERIAL DESCRIPTION	L	W	H	SF	WSA	P	Quantity	F or NF
Room 1	1	1	1	Misc	Drywall & Joint Compound	36	20	8	720	896	112	1600	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							112	Non-Friable
			4	Misc	4' White Ceiling Tile - Width Wide Fissures							720	Friable
			6	Misc	Carpet Mastic							720	Non-Friable
Room 2	2	1	1	Misc	Drywall & Joint Compound	12	10	8	120	352	44	500	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							44	Non-Friable
			3	Misc	4' White Ceiling Tile - Scatter Pattern Fissures							120	Friable
			6	Misc	Carpet Mastic							120	Non-Friable
Room 3	3	1	1	Misc	Drywall & Joint Compound	12	10	8	120	352	44	500	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							44	Non-Friable
			3	Misc	4' White Ceiling Tile - Scatter Pattern Fissures							120	Friable
			6	Misc	Carpet Mastic							120	Non-Friable



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Facility / Address:	Missouri ANG - Readiness Center 343 East Gay Street, Warrensburg, MO 64093	Date(s):	3/7/2023

ASBESTOS INSPECTION FUNCTIONAL SPACES

FUNCTIONAL SPACE NAME	FUNC. SPACE #	FLOOR	HM #	MAT. TYPE	MATERIAL DESCRIPTION	L	W	H	SF	WSA	P	Quantity	F or NF
Room 4	4	1	1	Misc	Drywall & Joint Compound	10	12	8	120	352	44	500	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							44	Non-Friable
			6	Misc	Carpet Mastic							120	Non-Friable
			12	Misc	4' X 2' Cream CT with width wide fissures							120	Friable
Room 5	5	1	1	Misc	Drywall & Joint Compound	12	10	8	120	352	44	500	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							44	Non-Friable
			3	Misc	4' White Ceiling Tile - Scatter Pattern Fissures							120	Friable
			6	Misc	Carpet Mastic							120	Non-Friable
Room 6	6	1	1	Misc	Drywall & Joint Compound	20	20	8	400	640	80	1100	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							80	Non-Friable
			3	Misc	4' White Ceiling Tile - Scatter Pattern Fissures							400	Friable
			6	Misc	Carpet Mastic							400	Non-Friable



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Facility / Address:	Missouri ANG - Readiness Center 343 East Gay Street, Warrensburg, MO 64093	Date(s):	3/7/2023

ASBESTOS INSPECTION FUNCTIONAL SPACES

FUNCTIONAL SPACE NAME	FUNC. SPACE #	FLOOR	HM #	MAT. TYPE	MATERIAL DESCRIPTION	L	W	H	SF	WSA	P	Quantity	F or NF
Room 7	7	1	1	Misc	Drywall & Joint Compound	20	36	8	720	896	112	1600	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							112	Non-Friable
			3	Misc	4' White Ceiling Tile - Scatter Pattern Fissures							720	Friable
			6	Misc	Carpet Mastic							720	Non-Friable
Room 8	8	1	7	TSI	Mudded Joint Fittings							6	Friable
			8	TSI	Water Heater Tank Wrap							6' x 3D	Friable
Room 9 Kitchen	9	1	1	Misc	Drywall & Joint Compound	20	16	8	320	576	72	1000	Non-Friable
			9	Misc	12" White Floor Tile with Gray Pattern & Mastic							320	Non-Friable
Room 10 Restroom/storage	10	1	1	Misc	Drywall & Joint Compound	20	12	8	240	512	64	750	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							65	Non-Friable
			10	Misc	4" Black Cove-base & Adhesive							240	Non-Friable
Room 11 Womens RR	11	1	1	Misc	Drywall & Joint Compound	20	16	8	320	576	72	550	Non-Friable
Room 12 Mens RR	12	1	1	Misc	Drywall & Joint Compound	20	21	8	420	656	82	675	Non-Friable



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Facility / Address:	Missouri ANG - Readiness Center 343 East Gay Street, Warrensburg, MO 64093	Date(s):	3/7/2023

ASBESTOS INSPECTION FUNCTIONAL SPACES

FUNCTIONAL SPACE NAME	FUNC. SPACE #	FLOOR	HM #	MAT. TYPE	MATERIAL DESCRIPTION	L	W	H	SF	WSA	P	Quantity	F or NF
Room 13	13	1	1	Misc	Drywall & Joint Compound	20	14	8	280	544	68	1000	Non-Friable
			2	Misc	4" Gray cover-base and adhesive							68	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							280	Friable
			6	Misc	Carpet Mastic							280	Non-Friable
Room 14	14	1	1	Misc	Drywall & Joint Compound	16	14	8	224	480	60	750	Non-Friable
			2	Misc	4" Gray cover-base and adhesive							60	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							225	Friable
			11	Misc	12" Gray Floor tile with white pattern							225	Non-Friable
Room 15	15	1	1	Misc	Drywall & Joint Compound	12	14	8	168	416	52	600	Non-Friable
			2	Misc	4" Gray cover-base and adhesive							52	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							170	Friable
			6	Misc	Carpet Mastic							170	Non-Friable



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Facility / Address:	Missouri ANG - Readiness Center 343 East Gay Street, Warrensburg, MO 64093	Date(s):	3/7/2023

ASBESTOS INSPECTION FUNCTIONAL SPACES

FUNCTIONAL SPACE NAME	FUNC. SPACE #	FLOOR	HM #	MAT. TYPE	MATERIAL DESCRIPTION	L	W	H	SF	WSA	P	Quantity	F or NF
Room 16	16	1	1	Misc	Drywall & Joint Compound	17	18	8	306	560	70	1000	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							70	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							310	Friable
			6	Misc	Carpet Mastic							310	Non-Friable
Room 17 Assembly/Vault	17	1	13	Misc	Vault Fire Door							1	Non-Friable
Room 18	18	1	1	Misc	Drywall & Joint Compound	14	14	8	196	448	56	750	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							56	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							200	Friable
Room 19	19	1	1	Misc	Drywall & Joint Compound	14	14	8	196	448	56	650	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							60	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							200	Friable



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Client:	Clark & Enerson	Project Number:	923088
Facility / Address:	Missouri ANG - Readiness Center 343 East Gay Street, Warrensburg, MO 64093	Date(s):	3/7/2023

ASBESTOS INSPECTION FUNCTIONAL SPACES

FUNCTIONAL SPACE NAME	FUNC. SPACE #	FLOOR	HM #	MAT. TYPE	MATERIAL DESCRIPTION	L	W	H	SF	WSA	P	Quantity	F or NF
Room 20	20	1	1	Misc	Drywall & Joint Compound	10	14	8	140	384	48	500	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							50	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							140	Friable
Room 21	21	1	1	Misc	Drywall & Joint Compound	10	14	8	140	384	48	550	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							50	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							140	Friable
Room 22	22	1	1	Misc	Drywall & Joint Compound	44	18	8	792	992	124	2000	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							124	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							800	Friable
Hallway 13 - 16	23	1	1	Misc	Drywall & Joint Compound	6	40	8	240	736	92	1100	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							92	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							250	Friable
			11	Misc	12" Gray Floor tile with white pattern							250	Non-Friable



OCCU-TEC

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Client:	Clark & Enerson	Project Number:	923088
Facility / Address:	Missouri ANG - Readiness Center 343 East Gay Street, Warrensburg, MO 64093	Date(s):	3/7/2023

ASBESTOS INSPECTION FUNCTIONAL SPACES

FUNCTIONAL SPACE NAME	FUNC. SPACE #	FLOOR	HM #	MAT. TYPE	MATERIAL DESCRIPTION	L	W	H	SF	WSA	P	Quantity	F or NF
Foyer	24	1	1	Misc	Drywall & Joint Compound	12	17	8	204	464	58	800	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							58	Non-Friable
			3	Misc	4' White Ceiling Tile - Scatter Pattern Fissures							210	Friable
			11	Misc	12" Gray Floor tile with white pattern							210	Non-Friable
Drill Floor	25	1	3	Misc	4' White Ceiling Tile - Scatter Pattern Fissures	115	60	16	6900	5600	350		Friable
			4	Misc	4' White Ceiling Tile - Width Wide Fissures								Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole								Friable
			6	Misc	Carpet Mastic								Non-Friable
			7	TSI	Mudded Joint Fittings							5	Friable
18 - 22 Hallway	26	1	1	Misc	Drywall & Joint Compound	5	48	8	240	848	106	1100	Non-Friable
			2	Misc	4" Gray cove-base and adhesive							110	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							250	Friable
Room 1 & 22 Hall	27	1	1	Misc	Drywall & Joint Compound	12	5	8	60	272	34	400	Non-Friable



OCCU-TEC

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Client:	Clark & Enerson	Project Number:	923088
Facility / Address:	Missouri ANG - Readiness Center 343 East Gay Street, Warrensburg, MO 64093	Date(s):	3/7/2023

ASBESTOS INSPECTION FUNCTIONAL SPACES

FUNCTIONAL SPACE NAME	FUNC. SPACE #	FLOOR	HM #	MAT. TYPE	MATERIAL DESCRIPTION	L	W	H	SF	WSA	P	Quantity	For NF
			2	Misc	4" Gray cove-base and adhesive							35	Non-Friable
			5	Misc	4' White Ceiling Tile - Poc & Pin Hole							60	Friable

APPENDIX E
XRF ANALYSIS RESULTS

Action	3-SD			Result	Action Level	Nom Sec	Date	Time	User	Mode	Analytic Mode	Floor	Room	Side	Component
	Units	3-SD	Result												
	mg/cm2	0.3	Negative	1	1	3/6/2023	8:51:59	Arnold	Action Level	Lead Paint	1st	Entry	West	Wall	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:52:22	Arnold	Action Level	Lead Paint	1st	Entry	West	Wall	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:54:08	Arnold	Action Level	Lead Paint	1st	4	West	Wall	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:54:34	Arnold	Action Level	Lead Paint	1st	4	West	Wall	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:55:19	Arnold	Action Level	Lead Paint	1st	4	South	Window Frame	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:55:38	Arnold	Action Level	Lead Paint	1st	4	South	Window Sash	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:56:14	Arnold	Action Level	Lead Paint	1st	4	North	Door Casing	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:56:29	Arnold	Action Level	Lead Paint	1st	4	North	Door Jamb	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:57:06	Arnold	Action Level	Lead Paint	1st	5	North	Door Jamb	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:57:23	Arnold	Action Level	Lead Paint	1st	5	North	Door Casing	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:58:06	Arnold	Action Level	Lead Paint	1st	5	South	Window Frame	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:58:23	Arnold	Action Level	Lead Paint	1st	5	South	Window Sash	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:58:54	Arnold	Action Level	Lead Paint	1st	5	South	Wall	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:59:20	Arnold	Action Level	Lead Paint	1st	5	South	Wall	
	mg/cm2	0.3	Negative	1	2	3/6/2023	8:59:53	Arnold	Action Level	Lead Paint	1st	5	South	Cove-base	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:04:37	Arnold	Action Level	Lead Paint	1st	7	South	Cove-base	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:05:33	Arnold	Action Level	Lead Paint	1st	7	East	Wall	
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:05:54	Arnold	Action Level	Lead Paint	1st	7	East	Wall	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:06:33	Arnold	Action Level	Lead Paint	1st	7	East	Window Frame	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:06:50	Arnold	Action Level	Lead Paint	1st	7	East	Window Sash	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:07:57	Arnold	Action Level	Lead Paint	1st	6	West	Door	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:08:39	Arnold	Action Level	Lead Paint	1st	6	West	Door Casing	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:08:55	Arnold	Action Level	Lead Paint	1st	6	West	Door Jamb	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:11:24	Arnold	Action Level	Lead Paint	1st	6	West	Door Casing	
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:11:41	Arnold	Action Level	Lead Paint	1st	6	West	Door Jamb	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:12:01	Arnold	Action Level	Lead Paint	1st	6	West	Door	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:12:40	Arnold	Action Level	Lead Paint	1st	6	West	Wall	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:13:02	Arnold	Action Level	Lead Paint	1st	6	West	Wall	
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:16:01	Arnold	Action Level	Lead Paint	1st	Mech Room 8/7	Wall		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:16:20	Arnold	Action Level	Lead Paint	1st	Mech Room 8/7	Wall		
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:17:38	Arnold	Action Level	Lead Paint	1st	Mech Room 8/7	Stair Riser		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:18:04	Arnold	Action Level	Lead Paint	1st	Mech Room 8/7	Stair Tread		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:18:33	Arnold	Action Level	Lead Paint	1st	Mech Room 8/7	Hand Rail		
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:18:55	Arnold	Action Level	Lead Paint	1st	Mech Room 8/7	Hand Rail		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:20:33	Arnold	Action Level	Lead Paint	1st	Mech Room 8/7	Wall		
	mg/cm2	0.4	Negative	1	1	3/6/2023	9:20:52	Arnold	Action Level	Lead Paint	1st	Mech Room 8/7	Wall		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:21:14	Arnold	Action Level	Lead Paint	1st	Mech Room 8/7	Wall		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:22:43	Arnold	Action Level	Lead Paint	1st	9	Wall		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:23:14	Arnold	Action Level	Lead Paint	1st	9	Wall		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:24:19	Arnold	Action Level	Lead Paint	1st	9	Wall		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:24:40	Arnold	Action Level	Lead Paint	1st	9	Wall		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:26:02	Arnold	Action Level	Lead Paint	1st	9	Cabinet Door		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:26:19	Arnold	Action Level	Lead Paint	1st	9	Cabinet Frame		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:26:56	Arnold	Action Level	Lead Paint	1st	9	Door		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:27:38	Arnold	Action Level	Lead Paint	1st	9	Door Casing		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:27:55	Arnold	Action Level	Lead Paint	1st	9	Door Jamb		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:28:51	Arnold	Action Level	Lead Paint	1st	Bathroom	Door Jamb		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:30:09	Arnold	Action Level	Lead Paint	1st	Bathroom	Door Casing		
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:30:42	Arnold	Action Level	Lead Paint	1st	Bathroom	Floor		
	mg/cm2	0.3	Positive	1	2	3/6/2023	9:31:17	Arnold	Action Level	Lead Paint	1st	Bathroom	Wall		

Location	Units	3 SD	Result	Action Level	Nom Sec	Date	Time	User	Mode	Analytic Mode	Floor	Room	Side	Component	Alerts	
															Count	Severity
Zone A	mg/cm2	0.4	Negative	1	1	3/6/2023	9:33:38	Arnold	Action Level	Lead Paint	1st	Bathroom	East	Wall	Count	1
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:33:53	Arnold	Action Level	Lead Paint	1st	Bathroom	South	Wall	Severity	2
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:34:12	Arnold	Action Level	Lead Paint	1st	Bathroom	West	Wall	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:35:26	Arnold	Action Level	Lead Paint	1st	Female Bathroom	North	Wall	Severity	3
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:35:43	Arnold	Action Level	Lead Paint	1st	Female Bathroom	East	Wall	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:36:01	Arnold	Action Level	Lead Paint	1st	Female Bathroom	South	Wall	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:36:17	Arnold	Action Level	Lead Paint	1st	Female Bathroom	West	Wall	Count	1
	mg/cm2	0.3	Positive	1	2	3/6/2023	9:37:22	Arnold	Action Level	Lead Paint	1st	Female Bathroom	North	Wall	Severity	3
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:37:44	Arnold	Action Level	Lead Paint	1st	Female Bathroom	North	Floor	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:38:29	Arnold	Action Level	Lead Paint	1st	Female Bathroom	Room Center	Ceiling	Severity	2
Zone B	mg/cm2	0.3	Negative	1	2	3/6/2023	9:40:17	Arnold	Action Level	Lead Paint	1st	Male Bathroom	Room Center	Ceiling	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:40:49	Arnold	Action Level	Lead Paint	1st	Male Bathroom	North	Wall	Severity	2
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:41:06	Arnold	Action Level	Lead Paint	1st	Male Bathroom	East	Wall	Count	1
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:41:22	Arnold	Action Level	Lead Paint	1st	Male Bathroom	South	Wall	Severity	2
	mg/cm2	0.4	Negative	1	1	3/6/2023	9:41:41	Arnold	Action Level	Lead Paint	1st	Male Bathroom	West	Wall	Count	1
	mg/cm2	0.3	Positive	1	2	3/6/2023	9:42:04	Arnold	Action Level	Lead Paint	1st	Male Bathroom	West	Wall	Severity	3
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:42:42	Arnold	Action Level	Lead Paint	1st	Male Bathroom	West	Wall	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:43:41	Arnold	Action Level	Lead Paint	1st	Male Bathroom	West	Wall	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:44:16	Arnold	Action Level	Lead Paint	1st	Male Bathroom	West	Door Casing	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:44:32	Arnold	Action Level	Lead Paint	1st	Male Bathroom	West	Door Jamb	Severity	2
Zone C	mg/cm2	0.3	Negative	1	2	3/6/2023	9:44:59	Arnold	Action Level	Lead Paint	1st	Male Bathroom	West	Door	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:45:42	Arnold	Action Level	Lead Paint	1st	13	West	Door	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:46:08	Arnold	Action Level	Lead Paint	1st	13	West	Door Casing	Count	1
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:46:23	Arnold	Action Level	Lead Paint	1st	13	West	Door Jamb	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:46:54	Arnold	Action Level	Lead Paint	1st	13	West	Wall	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:47:10	Arnold	Action Level	Lead Paint	1st	13	North	Wall	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:47:25	Arnold	Action Level	Lead Paint	1st	13	East	Wall	Count	1
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:47:45	Arnold	Action Level	Lead Paint	1st	13	East	Wall	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:48:30	Arnold	Action Level	Lead Paint	1st	13	West	Cove-base	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:49:02	Arnold	Action Level	Lead Paint	1st	14	West	Cove-base	Severity	2
Zone D	mg/cm2	0.3	Negative	1	2	3/6/2023	9:49:37	Arnold	Action Level	Lead Paint	1st	14	West	Wall	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:49:56	Arnold	Action Level	Lead Paint	1st	14	North	Wall	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:50:12	Arnold	Action Level	Lead Paint	1st	14	South	Wall	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:50:54	Arnold	Action Level	Lead Paint	1st	15	North	Wall	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:51:10	Arnold	Action Level	Lead Paint	1st	15	South	Wall	Count	1
	mg/cm2	0.3	Negative	1	1	3/6/2023	9:51:27	Arnold	Action Level	Lead Paint	1st	15	West	Wall	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:52:07	Arnold	Action Level	Lead Paint	1st	15	East	Window Case	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:52:32	Arnold	Action Level	Lead Paint	1st	15	West	Door Casing	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:52:50	Arnold	Action Level	Lead Paint	1st	15	West	Door Jamb	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:53:16	Arnold	Action Level	Lead Paint	1st	16	South	Door Jamb	Severity	2
Zone E	mg/cm2	0.3	Negative	1	2	3/6/2023	9:53:31	Arnold	Action Level	Lead Paint	1st	16	South	Door Casing	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:54:11	Arnold	Action Level	Lead Paint	1st	16	South	Wall	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:54:33	Arnold	Action Level	Lead Paint	1st	16	North	Wall	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:55:07	Arnold	Action Level	Lead Paint	1st	16	East	Window Case	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:55:25	Arnold	Action Level	Lead Paint	1st	16	East	Window Frame	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:56:25	Arnold	Action Level	Lead Paint	1st	13-16 hall	West	Wall	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	9:56:45	Arnold	Action Level	Lead Paint	1st	13-16 hall	East	Wall	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:01:46	Arnold	Action Level	Lead Paint	1st	18	East	Wall	Severity	2
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:02:02	Arnold	Action Level	Lead Paint	1st	18	South	Wall	Count	1
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:02:29	Arnold	Action Level	Lead Paint	1st	18	West	Wall	Severity	2

Location	Units	3 SD	Result	Action Level	Nom Sec	Date	Time	User	Mode	Analytic Mode	Floor	Room	Side	Component
Zone A	mg/cm2	0.3	Negative	1	2	3/6/2023	10:06:56	Arnold	Action Level	Lead Paint	1st	Vault Door	West	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:07:24	Arnold	Action Level	Lead Paint	1st	Vault Door	North	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:07:40	Arnold	Action Level	Lead Paint	1st	Vault Door	East	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:07:54	Arnold	Action Level	Lead Paint	1st	Vault Door	South	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:09:23	Arnold	Action Level	Lead Paint	1st	Vault Door	East	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:09:47	Arnold	Action Level	Lead Paint	1st	Vault Door	South	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:10:10	Arnold	Action Level	Lead Paint	1st	Vault Door	West	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:10:37	Arnold	Action Level	Lead Paint	1st	Vault Door	West	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:11:02	Arnold	Action Level	Lead Paint	1st	Vault Door	West	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:12:00	Arnold	Action Level	Lead Paint	1st	Vault Door	West	Door Casing
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:12:40	Arnold	Action Level	Lead Paint	1st	Vault Door	West	Door Jamb
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:12:55	Arnold	Action Level	Lead Paint	1st	Vault Door	West	Door
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:13:09	Arnold	Action Level	Lead Paint	1st	Vault Door	West	Door Casing
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:14:34	Arnold	Action Level	Lead Paint	1st	Vault Door	West	Door Casing
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:14:58	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Door Casing
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:15:15	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Door Casing
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:15:32	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Door Casing
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:17:27	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Door Jamb
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:17:43	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Door
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:18:33	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:19:04	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Wall
	mg/cm2	0.3	Negative	1	2	3/6/2023	10:20:09	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Floor
mg/cm2	0.3	Negative	1	2	3/6/2023	10:20:26	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Floor	
mg/cm2	0.3	Negative	1	2	3/6/2023	10:20:58	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Floor	
mg/cm2	0.3	Negative	1	2	3/6/2023	10:21:19	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Wall	
mg/cm2	0.3	Negative	1	2	3/6/2023	10:21:48	Arnold	Action Level	Lead Paint	1st	Door outside room	West	Wall	
mg/cm2	0.2	Calibration	1	5	3/6/2023	10:23:17	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.2	Calibration	1	5	3/6/2023	10:23:37	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.2	Calibration	1	5	3/6/2023	10:23:57	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Calibration	1	2	3/6/2023	10:24:23	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Calibration	1	2	3/6/2023	10:24:37	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Calibration	1	2	3/6/2023	10:24:46	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.2	Calibration	1	5	3/6/2023	14:05:13	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.2	Calibration	1	5	3/6/2023	14:05:35	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.2	Calibration	1	5	3/6/2023	14:05:56	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Calibration	1	2	3/6/2023	14:06:22	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Calibration	1	2	3/6/2023	14:06:32	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Calibration	1	2	3/6/2023	14:06:52	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:09:49	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:10:02	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:10:34	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:11:00	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:11:49	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:12:16	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:12:31	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:13:01	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:13:31	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:13:46	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall
mg/cm2	0.3	Negative	1	2	3/6/2023	14:14:08	Arnold	Action Level	Lead Paint	1st	Room	22	West	Wall

Location	Units	3 SD	Result	Action Level	Nom Sec	Date	Time	User	Mode	Analytic Mode	Floor	Room	Side	Component
	mg/cm2	0.3	Negative	1	2	3/6/2023	14:14:57	Arnold	Action Level	Lead Paint	Exterior		East	Hand Rail
	mg/cm2	0.3	Negative	1	2	3/6/2023	14:15:18	Arnold	Action Level	Lead Paint	Exterior		East	Post
	mg/cm2	0.3	Negative	1	1	3/6/2023	14:15:39	Arnold	Action Level	Lead Paint	Exterior		East	Door
	mg/cm2	0.3	Negative	1	2	3/6/2023	14:15:54	Arnold	Action Level	Lead Paint	Exterior		East	Door Casing
	mg/cm2	0.3	Negative	1	2	3/6/2023	14:16:09	Arnold	Action Level	Lead Paint	Exterior		East	Door Jamb
	mg/cm2	0.2	Negative	1	5	3/6/2023	14:16:45	Arnold	Action Level	Lead Paint	Exterior		East	Soffit
	mg/cm2	0.3	Negative	1	2	3/6/2023	14:17:27	Arnold	Action Level	Lead Paint	Exterior		East	Fascia
	mg/cm2	0.2	Calibration	1	5	3/6/2023	14:20:03	Arnold	Action Level	Lead Paint				
	mg/cm2	0.2	Calibration	1	5	3/6/2023	14:20:24	Arnold	Action Level	Lead Paint				
	mg/cm2	0.2	Calibration	1	5	3/6/2023	14:20:44	Arnold	Action Level	Lead Paint				
	mg/cm2	0.3	Calibration	1	2	3/6/2023	14:21:10	Arnold	Action Level	Lead Paint				
	mg/cm2	0.3	Calibration	1	2	3/6/2023	14:21:20	Arnold	Action Level	Lead Paint				
	mg/cm2	0.3	Calibration	1	2	3/6/2023	14:21:28	Arnold	Action Level	Lead Paint				

Table 4.1 Warrensburg Readiness Center - Household Hazardous Waste Inventory

Item	Readiness Center
2 Bulb 4' Florescent Light Ballasts (1 Ballast ea.)	156
Emergency Exit Signs	6
Air Conditioning Units (IT)	*Present
Compressors	*Present
Refrigerant Canisters	*Present
HVAC Units (Roof Condensers)	*Present
<i>*Please note that AC compressors, refrigerant canisters, air conditioners, and HVAC Units are present in the building</i>	