PROJECT MANUAL

Repair Swimming Pool

Missouri School for the Blind

St. Louis, Missouri

Designed By: Oates Associates
720 Olive, Suite 700
St. Louis, MO 63101

Date Issued: July 6, 2022

Project No.: E2107-01

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION

Facilities Management, Design & Construction

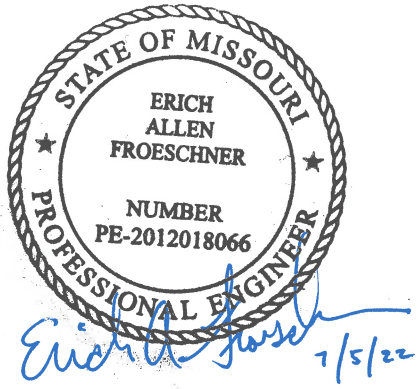
DOCUMENT 000107 - SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

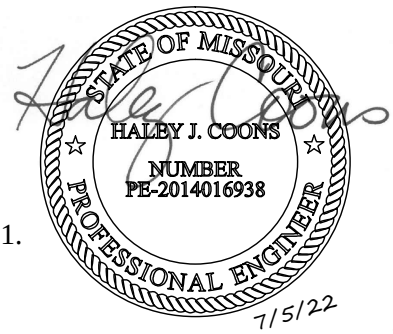
1. Michael Ratliff
2. 6855
3. Responsible for Divisions 2, 7, 8, 9 and 10.

B. Aquatics Engineer:
1. Erich Froeschner
2. PE-2012078066
3. Responsible for Division 13.



C. Structural Engineer:

1. Haley J. Coons
2. PE-2014016938
3. Responsible for Divisions 3 and 31.



D. Mechanical Engineer:

1. Mike Hoff
2. PE201300576
3. Responsible for Divisions 22 and 23.

E. Electrical Engineer:

1. Carl Hauck
2. E-16688
3. Responsible for Division 26.

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F. Environmental Engineer:

1. Jessica Keeven
2. 16637
3. Responsible for Division 2.

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1.1 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Repair Swimming Pool, dated March 22, 2022, as modified by subsequent Addenda and Contract modifications.

B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

TITLE	SHEET #	DATE
Cover Sheet	G-001	07/06/2022
Index of Sheets	G-002	07/06/2022
Location Maps and Key Plan	G-003	07/06/2022
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Plumbing Accessories	A-203	07/06/2022
Ceiling Plans	A-401	07/06/2022
Finish Legend & Schedule	A-500	07/06/2022
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Door Schedule/Door, Frame Types	A-901	07/06/2022
Partition Types	A-902	07/06/2022
Details	A-903	07/06/2022
Pool Reference Plan	AQ-000	07/06/2022
Pool Demolition & Renovation Plan	AQ-001	07/06/2022
Pool Plan & Section	AQ-100	07/06/2022
Pool Details	AQ-101	07/06/2022
Pool Piping Plans	AQ-200	07/06/2022
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Pool Mechanical Details	AQ-301	07/062022
Pool Mechanical Details	AQ-302	07/06/2022
Pool Mechanical Details	AQ-303	07/06/2022
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Pool Systems Schematic	AQ-400	07/06/2022
General Notes	S-001	07/06/2022
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Demolition Plan	S-100	07/06/2022

Pool Plan	S-101	07/06/2022
Legend & Notes – Mechanical	M-001	07/06/2022
Overall Plan – Mechanical	M-100	07/06/2022
Enlarged Pool Plans – Mechanical	M-200	07/06/2022
Boy's Locker Room Plans	M-201	07/06/2022
Girl's Locker Room Plans	M-202	07/062022
Details and Schedules – Mechanical	M-500	07/06/2022
Details and Schedules – Mechanical	M-501	07/06/2022
Legends, Symbols, & Notes – Electrical	E-001	07/06/2022
Overall Plan – Basement	E-100	07/06/2022
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Panel Board Schedules	E-601	07/06/2022

END OF DOCUMENT 000115

SECTION 001116 - INVITATION FOR BID

1.0 OWNER:

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

2.0 PROJECT TITLE AND NUMBER:

A. Repair Swimming Pool
Missouri School for the Blind
St. Louis, Missouri
Project No.: E2107-01

3.0 BIDS WILL BE RECEIVED:

A. Until: 1:30 PM, Thursday, November 17, 2022

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 improvements in the pool room and adjacent mechanical room. Remove and replace entire existing concrete pool deck around perimeter of pool and add depth markings and warning signs. Demolish top of pool wall and gutter and install new coping stone around perimeter of pool. Add three in-wall skimmers and piping back to filtration pump. Replace deck drain system. Remove the existing diving stand support. Remove and salvage two existing pool ladders and install new ladders. Install new padding at pool end walls. Remove main drain and pool slab as needed to install new main drain and associated piping to mechanical room. Anchor existing chair lift to pool deck. Improvements to the mechanical room include removing all mechanical equipment and exposed piping. Remove and replace existing sump pit and grating. Install new recirculation pump, filter heater and piping. Install WLC and UV system for pool. Install new pool chemical treatment system and eyewash station.

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.

5.0 PRE-BID MEETING:

A. Place/Time**:** 11:00 AM Tuesday, November 1, 2022, at Missouri School for the Blind, 3815 Magnolia Avenue, St. Louis, MO.

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

6.0 HOW TO GET PLANS & SPECIFICATIONS:

A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of $100.00 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, https://www.adsplanroom.net. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate. Additional bid sets or parts thereof may be obtained by any bidder at the cost of printing and shipping by request to American Document Solutions at the address shown above. **Bidder must secure at least one bid set to become a planholder.**

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

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

7.0 POINT OF CONTACT:

A. Designer: Oates Associates, Haley Coons, 314-588-8381 x 216, email: haley.coons@oatesassociates.com

B. Project Manager: Sandra Walther, 573-751-2283, 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.

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.

IMPORTANT REMINDER REGARDING REQUIREMENT FOR OEO CERTIFICATION

A. SECTION 002113 – INSTRUCTIONS TO BIDDERS: Article 15.0, Section D1:

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

SECTION 002113 – INSTRUCTIONS TO BIDDERS

1.0 - SPECIAL NOTICE TO BIDDERS

A. If awarded a contract, the Bidder's employees, and the employees of all subcontractors, who perform the work on the project 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. In awarding the contract the Owner may take into consideration the bidder's skill, facilities, capacity, experience, responsibility, previous work record, financial standing and the necessity of prompt and efficient completion of work herein described. Inability of any bidder to meet the requirements mentioned above may be cause for rejection of his bid. However, no contract will be awarded to any individual, partnership or corporation, who has had a contract with the State of Missouri declared in default within the preceding twelve months.

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

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

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

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

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

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

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

10.0 - CONTRACT SECURITY

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

11.0 - LIST OF SUBCONTRACTORS

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

clear, by listing his own firm for the subject category. **If any category of work is left vacant, the bid shall be rejected.**

12.0 - WORKING DAYS

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

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

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

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

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

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

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

https://vetbiz.va.gov/basic-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 Elementary and Secondary Education.

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:	**Repair Swimming Pool** **Missouri School for the Blind** **St. Louis, Missouri**
Project Number:	**E2107-01**

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 **155 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)

UNIT PRICES: The Owner accepts the following Unit Prices:

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

ARTICLE 5. PREVAILING WAGE RATE

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

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

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

The Contractor has been granted a waiver of the 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)		

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

Bond No._____

SECTION 006113 - PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS, THAT we _____

as principal, and _____

_____as Surety, are held and firmly bound unto the

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

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

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

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

_____

_____

_____

(Insert Project Title and Number)

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

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

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

AS APPLICABLE:

AN INDIVIDUAL

Name: _____

Signature: _____

A PARTNERSHIP

Name of Partner: _____

Signature of Partner: _____

Name of Partner: _____

Signature of Partner: _____

CORPORATION

Firm Name: _____

Signature of President: _____

SURETY

Surety Name: _____

Attorney-in-Fact: _____

Address of Attorney-in-Fact: _____

_____

Telephone Number of Attorney-in-Fact: _____

Signature Attorney-in-Fact: _____

NOTE: Surety shall attach Power of Attorney

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

PRODUCT SUBSTITUTION REQUEST

PROJECT NUMBER

PROJECT TITLE AND LOCATION

CHECK APPROPRIATE BOX

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

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

FROM: BIDDER/CONTRACTOR (PRINT COMPANY NAME)

TO: ARCHITECT/ENGINEER (PRINT COMPANY NAME)

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

SPECIFIED PRODUCT OR SYSTEM

SPECIFICATION SECTION NO.

SUPPORTING DATA

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

☐ Sample ☐ Sample will be sent, if requested

QUALITY COMPARISON

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

PREVIOUS INSTALLATIONS

PROJECT	ARCHITECT/ENGINEER	
LOCATION		DATE INSTALLED

SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT

REASON FOR SUBSTITUTION

DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?

☐ YES ☐ NO

IF YES, EXPLAIN

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

☐ YES ☐ NO

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

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

BIDDER/CONTRACTOR	DATE

REVIEW AND ACTION

☐ Resubmit Substitution Request with the following additional information:

☐ Substitution is accepted.

☐ Substitution is accepted with the following comments:

☐ Substitution is not accepted.

ARCHITECT/ENGINEER	DATE

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

FINAL RECEIPT OF PAYMENT AND RELEASE

PROJECT NUMBER

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

(PROJECT TITLE, PROJECT LOCATION, AND PROJECT NUMBER)

at

(ADDRESS OF PROJECT)

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

DOES HEREBY:

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

DATED this day of , 20 .

NAME OF SUBCONTRACTOR

BY (TYPED OR PRINTED NAME)

SIGNATURE

TITLE

ORIGINAL: FILE/Closeout Documents

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

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

MBE/WBE/SDVE PROGRESS REPORT

Remit with **ALL** Progress and Final Payments

(Please check appropriate box) ☐CONSULTANT ☐CONSTRUCTION

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	TOTAL AMOUNT OF SUBCONTRACT	$ AMOUNT PAID-TO-DATE	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER COMPANY NAME
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	

Revised 05/21

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

PROJECT NUMBER

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

State of _____ personally came and appeared _____
(NAME)

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

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

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

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

SIGNATURE

NOTARY INFORMATION

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

FILE: Closeout Documents

GENERAL CONDITIONS

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ARTICLE:

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1.2. Drawings and Specifications

1.3. Compliance with Laws, Permits, Regulations and Inspections

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1.9. Separate Contracts and Cooperation

1.10. Assignment of Contract

1.11. Indemnification

1.12. Disputes and Disagreements

2. Owner/Designer Responsibilities

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SECTION 007213 - GENERAL CONDITIONS

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

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

ARTICLE 1 – GENERAL PROVISIONS

ARTICLE 1.1 - DEFINITIONS

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

1. **"COMMISSIONER":** The Commissioner of the Office of Administration.
2. **"CONSTRUCTION DOCUMENTS":** The "Construction Documents" shall consist of the Project Manual, Drawings and Addenda.
3. **"CONSTRUCTION REPRESENTATIVE:"** Whenever the term "Construction Representative" is used, it shall mean the Owner's Representative at the work site.
4. **"CONTRACTOR"**: Party or parties who have entered into a contract with the Owner to furnish work under these specifications and drawings.
5. **"DESIGNER"**: When the term "Designer" is used herein, it shall refer to the Architect, Engineer, or Consultant of Record specified and defined in Paragraph 2.0 of the Supplemental Conditions, or his duly authorized representative. The Designer may be either a consultant or state employee.
6. **"DIRECTOR"**: Whenever the term "Director" is used, it shall mean the Director of the Division of Facilities Management, Design and Construction or his Designee, representing the Office of Administration, State of Missouri. The Director is the agent of the Owner.
7. **"DIVISION":** Shall mean the Division of Facilities Management, Design and Construction, State of Missouri.
8. **"INCIDENTAL JOB BURDENS":** Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.
9. **"JOINT VENTURE"**: An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.
10. **"OWNER"**: Whenever the term "Owner" is used, it shall mean the State of Missouri.
11. **"PROJECT"**: Wherever the term "Project" is used, it shall mean the work required to be completed by the construction contract.
12. **"PROJECT MANUAL"**: The "Project Manual" shall consist of Introductory Information, Invitation for Bid, Instructions to Bidders, Bid Documents, Additional Information, Standard Forms, General Conditions, Supplemental General Conditions, General Requirements and Technical Specifications.
13. **"SUBCONTRACTOR"**: Party or parties who contract under, or for the performance of part or this entire Contract between the Owner and Contractor. The subcontract may or may not be direct with the Contractor.
14. **"WORK"**: Labor, material, supplies, plant and equipment required to perform and complete the service agreed to by the Contractor in a safe, expeditious, orderly and workmanlike manner so that the project shall be complete and finished in the best manner known to each respective trade.
15. "**WORKING DAYS**": are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, 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 negotiated, and may vary according to the nature, extent, and complexity of the work involved. However, the overhead and profit for the Contractor or subcontractor actually performing the work shall not exceed 14%. When one or more tiers of subcontractors are used, in no event shall any Contractor or subcontractor receive as overhead and profit more than 3% of the cost of the work performed by any of his subcontractors. In no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty percent (20%) of the cost of materials, labor and equipment (exclusive of Contractor or any Subcontractor overhead and profit) necessary to put the contract change work in place.

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

4. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work.

5. The percentage for overhead and profit to be credited to the Owner on Contract Changes that are solely decreases in the quantity of work or materials shall be negotiated, and may vary according to the nature, extent and complexity of the work involved, but in no case shall be less than ten percent (10%). If the percentage for overhead and profit charged for work added by Contract Changes for this contract has been negotiated to less than 10%, the negotiated rate shall then apply to credits as well.

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

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

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

ARTICLE 4.2 – CHANGES IN COMPLETION TIME

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

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

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

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

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

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

2. Labor strikes or acts of God occur, OR

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

C. No time extension or compensation will be provided for delays caused by or within the control

of the Contractor, subcontractors or suppliers and for concurrent delays caused by the Owner.

D. The Contractor shall notify the Owner promptly of any occurrence or conditions which in the Contractor's opinion results in a need for an extension of time. The notice shall be in writing and shall include all necessary supporting materials with details of any resultant costs and be submitted in time to permit full investigation and evaluation of the Contractor's claim. The Owner shall promptly acknowledge the Contractor's notice and, after recommendation from the Owner's Representative and/or Designer, shall provide a decision to the Contractor. Failure on the part of the Contractor to provide such notice and to detail the costs shall constitute a waiver by the Contractor of any claim. Requests for extensions of time shall be for working days only.

ARTICLE 5 - CONSTRUCTION AND COMPLETION

ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT

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

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

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

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

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

ARTICLE 5.2 -- PROJECT CONSTRUCTION

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

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

ARTICLE 5.3 -- PROJECT COMPLETION

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

1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
   a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
   b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
   c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working

days notice before the inspection shall be performed.

2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.

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

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

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

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

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

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will

be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make payment within 30 calendar days after the "Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:

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

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

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

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

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

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

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

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

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

1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or

items. The cost of corrective action(s) shall be borne by the Contractor.

2. A reasonable doubt that this contract can be completed for the unpaid balance.

3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.

4. Failure of the Contractor to update the construction schedule.

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

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

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

2. The final payment shall not become due until the Contractor delivers to the Construction Representative:

a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from the Surety to final payment accepting liability for any unpaid amounts.

b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor

c) Certified copies of all payrolls

d) As-built drawings

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

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

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

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

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

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

ARTICLE 6.2 – INSURANCE

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

B. Minimum Scope and Extent of Coverage

1. General Liability

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

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

2. Automobile Liability

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

3. Workers' Compensation and Employer's Liability

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

4. Builder's Risk or Installation Floater Insurance

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

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

C. Minimum Limits of Insurance

1. General Liability

Contractor

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

2. Automobile Liability

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

3. Workers' Compensation and Employers Liability

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

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

D. Deductibles and Self-Insured Retentions

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

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

E. Other Insurance Provisions and Requirements

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

1. General Liability

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

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

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

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

2. Automobile Insurance

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

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

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

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

3. Workers' Compensation/Employer's Liability

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

4. All Coverages

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

F. Insurer Qualifications and Acceptability

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

G. Verification of Insurance Coverage

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

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

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

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:
Haley Coons
Oates Associates
720 Olive, Suite 700
St. Louis, MO 63101
Telephone: 314-588-8381 x 216
Email: haley.coons@oatesassociates.com

Construction Representative:
Michael Howard
Division of Facilities Management, Design and Construction
119 Olympic Way
St. Peters, MO 63376
Telephone: 636-524-8503
Email: mike.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: 573-751-2283
Email: sandra.walther@oa.mo.gov

Contract Specialist:
Paul Girouard
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: (573) 751-4797
Email: paul.girouard@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 LEAD AND ASBESTOS CERTIFICATION REQUIREMENTS:

From SECTION 007213 – GENERAL CONDITIONS, Article 5.4.H.2, ADD receipt of Certification from Contractor meeting the requirements set forth in SECTION 013513.16 – SITE SECURITY AND HEALTH REQUIREMENTS, 3.4., NO ASBESTOS AND NO LEAD CERTIFICATION.

Missouri
Division of Labor Standards
WAGE AND HOUR SECTION

MICHAEL L. PARSON, Governor

Annual Wage Order No. 29

Section 096
CITY OF ST. LOUIS CITY

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 10, 2022**

Last Date Objections May Be Filed: **April 11, 2022**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	$64.38
Boilermaker	$39.40*
Bricklayer	$60.67
Carpenter	$59.02
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	$53.06
Plasterer	
Communications Technician	$59.99
Electrician (Inside Wireman)	$71.98
Electrician Outside Lineman	$67.58
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	$91.46
Glazier	$64.67
Ironworker	$65.52
Laborer	$51.43
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	$39.40*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	$65.22
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	$40.84
Plumber	$73.90
Pipe Fitter	
Roofer	$55.02
Sheet Metal Worker	$70.01
Sprinkler Fitter	$76.17
Truck Driver	$39.40*
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 Section 290.210 RSMo.

Heavy Construction Rates for
City of ST. LOUIS CITY

Section 096

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	$48.40
Millwright	
Pile Driver	
Electrician (Outside Lineman)	$67.58
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	$49.07
General Laborer	
Skilled Laborer	
Operating Engineer	$65.72
Group I	
Group II	
Group III	
Group IV	
Truck Driver	$39.40*
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. 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 Section 290.210 RSMo.

OVERTIME
and
HOLIDAYS

OVERTIME

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

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

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

HOLIDAYS

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

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

SECTION 011000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of improvements at the campus of the Missouri School for the Blind.
   1. Project Location: Missouri School for the Blind (3815 Magnolia Avenue, St. Louis Missouri 65102).
   2. Owner: State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S Truman State Office Building, Post Office Box 809, 301 West High Street, Jefferson City, Missouri 65102.

B. Contract Documents dated July 6th, 2022, were prepared for the Project by Oates Associates, Inc. (720 Olive Street, Suite 700 St. Louis, Missouri 63101).

C. The Work consists of improvements in the in the pool room and adjacent mechanical room.
   1. The Work includes construction operations throughout the campus of the Missouri School for the Blind. The work includes:
      a. Pool Room: Remove and replace entire existing concrete pool deck around perimeter of pool and add depth markings and warning signs. Demolish top of pool wall and gutter and install new coping stone around perimeter of pool. Add three in-wall skimmers and piping back to filtration pump. Replace deck drain system. Remove the existing diving stand support. Remove and salvage two existing pool ladders and install new ladders. Install new padding at pool end walls. Remove main drain and pool slab as needed to install new main drain and associated piping to mechanical room. Anchor existing chair lift to pool deck.
      b. Mechanical Room: Remove all mechanical equipment and exposed piping in mechanical room. Remove and replace existing sump pit and grating. Install new recirculation pump, filter heater and piping. Install WLC and UV system for pool. Install new pool chemical treatment system and eyewash station.

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

1.3 WORK UNDER OTHER CONTRACTS

A. Cooperate fully with separate contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.4 WORK SEQUENCE

A. The Work shall be conducted in phases as needed by the contractor. Please note that a separate project that includes HVAC upgrades in the Pool Room and Locker Rooms is planned and may overlap with this project for demolition and construction. The contractor shall coordinate all schedules and work with the other project.

B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates for all phases of the Work.

1.5 CONTRACTOR USE OF PREMISES

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

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

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

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.

1.6 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy the adjacent areas during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations in adjacent areas.

1.7 MISCELLANEOUS PROVISIONS

A. SPECIFICATION AND DRAWING CONVENTIONS

1. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   a. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

b. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012200 – UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

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

1.2 SUMMARY

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

B. Related Sections include the following:

1. Division 1 Section "Allowances" for procedures for using Unit Prices to adjust quantity allowances.
2. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Division <Insert Division number> Section "<Insert Section title>"for procedures for measurement and payment for <Insert unit-price item>.

1.3 DEFINITIONS

A. Unit Price is a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

A. Unit Price No. 1 – Void Backfill:

1. Description: Void backfill with flowable fill as required to fill any voids discovered during demolition of concrete slab-on-grade in the pool room according to Division 312000 Section "Earth Moving."

2. Unit of Measurement: Cubic yard.

3. Base Bid Quantity: 10 cubic yards.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

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

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

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

1.4 PROCEDURES

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Replace Pool Tile: Remove and replace all of the existing tile inside the pool on the walls and floor as indicated in the plans and details on Drawings A-500, A-501. Refer to the specifications for primary work requirements.

B. Alternate No. 2: Replace Pool Room Wall Tile: Remove and replace all of the existing tile on the walls of the pool room as indicated in the plans and details on Drawings A-202, A-500. Refer to the specifications for primary work requirements.

C. Alternate No. 3: Renovate Boys' and Girls' Locker Rooms: Demolish interior finishes, fixtures, concrete slab-on-grade, and utilities as needed to renovate the Boys' and Girls' Locker Rooms. Construct utility upgrades and pour a new concrete slab-on-grade in areas of removal. Install new shower stalls, toilets, urinals, lockers, and partition walls in both areas. Replace existing doors and finishes as shown on Drawings A-201, A-202, A-203 and A-502. Refer to specifications for primary work requirements.

D. Alternate No. 4: Pool Deck Epoxy Finish: Provide epoxy flooring on pool deck in lieu of concrete sealer as indicated in the plans and details on Drawings A-500 and A-501. Refer to the specifications for primary work requirements.

END OF SECTION 012300

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 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 012200 "Unit Prices" for administrative requirements for using Unit Prices.
   3. Division 1, Section 013115 “Project Management Communications” for administrative requirements for communications.
   4. Division 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
   5. Division 0, Section 007213, Article 4.0 "Changes in the Work" for Contract Change requirements.

1.3 REQUESTS FOR INFORMATION

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

B. Responses to RFI shall be issued within 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 Contactor 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 Contract Change 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 Contract Change Detailed Breakdown form. Subcontractors may use the appropriate Contract Change Detailed Breakdown form or submit their proposal on their letterhead provided the same level of detail is included. All proposals shall include:
      a. A detailed breakdown of costs per Article 4.1 of the General Conditions.
      b. If requesting additional time per Article 4.2 of the General Conditions, include an updated Contractor's Construction Schedule that indicates the effect of the Change including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

1.6 CONTRACT CHANGE PROCEDURES

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

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. Related Sections including 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) workdays of starting construction operations, submit a list of key personnel assignments including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 PROJECT MEETINGS

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

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

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

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

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

1. Attendees: Installer and representatives of Manufacturers and Fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Designer and Construction Representative of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration including requirements for the following:

a. Contract Documents

b. Options

c. Related RFIs

d. Related Contract Changes

e. Purchases

f. Deliveries

g. Submittals

h. Review of mockups

i. Possible conflicts

j. Compatibility problems

k. Time schedules

l. Weather limitations

m. Manufacturer's written recommendations

n. Warranty requirements

o. Compatibility of materials

p. Acceptability of substrates

q. Temporary facilities and controls

r. Space and access limitations

s. Regulations of authorities having jurisdiction

t. Testing and inspecting requirements

u. Installation procedures

v. Coordination with other Work

w. Required performance results

x. Protection of adjacent Work

y. Protection of construction and personnel

3. Contractor shall record significant conference discussions, agreements, and disagreements including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

6. 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 location[1] 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 system[2] 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 – SCHEDULES - 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 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 Bi-Weekly 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 courtyard, lobby, work along Magnolia Street, 2nd Story Administrative offices, perimeter security, 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 another 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 24”x36”.

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 two (2) sets of prints, black and white, glossy; 8”x10” size; mounted on 8½”x11” soft card stock with left edge binding margin for 3-hole punch.
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. See individual Sections for additional information and for submittals not listed below.

SPEC SECTION	TITLE	CATEGORY
012100	Allowances (Bad Weather Days)	Certification
013200	Schedules	Construction Schedule
013200	Schedules	Schedule of Values
013200	Schedules	List of Subcontractors
013200	Schedules	Major Material Suppliers
024119	Selective Demolition	As-Builts
033000	Cast-in-Place Concrete	Shop Drawings
033000	Cast-in-Place Concrete	Product Data
033000	Cast-in-Place Concrete	Certification
033000	Cast-in-Place Concrete	Test Report
078413	Penetration Firestopping	Shop Drawings
078413	Penetration Firestopping	Product Data
078413	Penetration Firestopping	Test Report
078413	Penetration Firestopping	Warranty
079200	Joint Sealants	Product Data

079200	Joint Sealants	Sample
079200	Joint Sealants	Test Report
079200	Joint Sealants	Warranty
081113	Hollow Metal Doors & Frames	Shop Drawings
081113	Hollow Metal Doors & Frames	Product Data
081113	Hollow Metal Doors & Frames	Test Report
081113	Hollow Metal Doors & Frames	Warranty
087100	Door Hardware	Shop Drawings
087100	Door Hardware	Product Data
087100	Door Hardware	Operation / Maintenance Manual
087100	Door Hardware	Warranty
092216	Non-Structural Metal Framing	Product Data
092216	Non-Structural Metal Framing	Certification
092300	Gypsum Plastering	Product Data
092300	Gypsum Plastering	Sample
092900	Gypsum Board	Product Data
093013	Ceramic Tiling	Shop Drawings
093013	Ceramic Tiling	Product Data
093013	Ceramic Tiling	Sample
097050	Epoxy Resin Flooring	Shop Drawings
097050	Epoxy Resin Flooring	Product Data
097050	Epoxy Resin Flooring	Sample
097050	Epoxy Resin Flooring	Operation / Maintenance Manual
097050	Epoxy Resin Flooring	Warranty
097510	Solid Surface Wall Cladding	Product Data
097510	Solid Surface Wall Cladding	Operation / Maintenance Manual
099123	Interior Painting	Shop Drawings
099123	Interior Painting	Product Data
099123	Interior Painting	Sample
099123	Interior Painting	Operation / Maintenance Manual
102113.19	Plastic Toilet Compartments	Shop Drawings
102113.19	Plastic Toilet Compartments	Product Data
102113.19	Plastic Toilet Compartments	Sample
102113.19	Plastic Toilet Compartments	Certification
131100	Swimming Pool	Shop Drawings
131100	Swimming Pool	Product Data
131100	Swimming Pool	Operation / Maintenance Manual
131100	Swimming Pool	Warranty

131100	Swimming Pool	As-Builts
131103	Swimming Pool Tile	Shop Drawings
131103	Swimming Pool Tile	Sample
131103	Swimming Pool Tile	Product Data
131103	Swimming Pool Tile	Operation / Maintenance Manual
131103	Swimming Pool Tile	Warranty
220500	Common Work Results For Plumbing	Product Data
220500	Common Work Results For Plumbing	Certification
220500	Common Work Results For Plumbing	As-Builts
220523	General Duty Valves for Plumbing Piping	Product Data
220523	General Duty Valves for Plumbing Piping	Operation / Maintenance Manual
220529	Hangers and Supports for Plumbing Piping	Product Data
220529	Hangers and Supports for Plumbing Piping	Shop Drawings
220529	Hangers and Supports for Plumbing Piping	Certification
220548	Seismic Protection for Plumbing Piping and Equipment	Product Data
220548	Seismic Protection for Plumbing Piping and Equipment	Certification
220548	Seismic Protection for Plumbing Piping and Equipment	Shop Drawings
220548	Seismic Protection for Plumbing Piping and Equipment	Operation / Maintenance Manual
220553	Identification for Plumbing Piping and Equipment	Product Data
220553	Identification for Plumbing Piping and Equipment	Sample
220553	Identification for Plumbing Piping and Equipment	Product Data
220553	Identification for Plumbing Piping and Equipment	Operation / Maintenance Manual
220700	Plumbing Insulation	Product Data
220700	Plumbing Insulation	Shop Drawings
220700	Plumbing Insulation	Sample
220700	Plumbing Insulation	Certification
220700	Plumbing Insulation	Test Report
221116	Domestic Water Piping	Product Data
221116	Domestic Water Piping	Test Report
221116	Domestic Water Piping	Shop Drawings
221119	Domestic Water Piping Specialty	Product Data
221119	Domestic Water Piping Specialty	Shop Drawings
221119	Domestic Water Piping Specialty	Test Report

221119	Domestic Water Piping Specialty	Operation / Maintenance Manual
221316	Sanitary Waste and Vent Piping	Product Data
221316	Sanitary Waste and Vent Piping	Shop Drawings
221316	Sanitary Waste and Vent Piping	Test Report
221319	Sanitary Piping Specialties	Product Data
221319	Sanitary Piping Specialties	Certification
221319	Sanitary Piping Specialties	Test Report
221319	Sanitary Piping Specialties	Operation / Maintenance Manual
224000	Plumbing Fixtures	Product Data
224000	Plumbing Fixtures	Shop Drawings
224000	Plumbing Fixtures	Operation / Maintenance Manual
230500	Common Work Results for HVAC	Product Data
230500	Common Work Results for HVAC	Certification
230519	Meters and Gages for HVAC Piping	Product Data
230519	Meters and Gages for HVAC Piping	Shop Drawings
230519	Meters and Gages for HVAC Piping	Certification
230519	Meters and Gages for HVAC Piping	Operation / Maintenance Manual
230529	Hangers and Supports for HVAC Piping and Equipment	Product Data
230529	Hangers and Supports for HVAC Piping and Equipment	Shop Drawings
230548	Vibration and Seismic Controls for HVAC	Product Data
230548	Vibration and Seismic Controls for HVAC	Shop Drawings
230548	Vibration and Seismic Controls for HVAC	Certification
230548	Vibration and Seismic Controls for HVAC	Test Report
230553	Identification for HVAC Piping and Equip-ment	Product Data
230593	Testing, Adjusting, and Balancing for HVAC	Certification
230593	Testing, Adjusting, and Balancing for HVAC	Test Report
230593	Testing, Adjusting, and Balancing for HVAC	Shop Drawings
233113	Ductwork	Product Data
233113	Ductwork	Shop Drawings
233423	HVAC Power Ventilators	Product Data
233423	HVAC Power Ventilators	Shop Drawings
233423	HVAC Power Ventilators	Test Report
238216	Electric-Resistance Air Coils	Product Data

238216	Electric-Resistance Air Coils	Shop Drawings
238216	Electric-Resistance Air Coils	Operation / Maintenance Manual
260533	Conduit	Shop Drawings
260533	Conduit	Product Data
260535	Boxes	Shop Drawings
260535	Boxes	Product Data
260548	Vibration & Seismic Controls for Elec Sys.	Shop Drawings
260548	Vibration & Seismic Controls for Elec Sys.	Product Data
260548	Vibration & Seismic Controls for Elec Sys.	Certification
260553	Identification for Electrical Systems	Product Data
260923	Lighting Control Devices	Shop Drawings
260923	Lighting Control Devices	Product Data
260923	Lighting Control Devices	Test Report
262726	Wiring Devices	Shop Drawings
262726	Wiring Devices	Product Data
262726	Wiring Devices	Test Report
262816	Enclosed Switches	Shop Drawings
262816	Enclosed Switches	Product Data
265100	Interior Lighting	Shop Drawings
265100	Interior Lighting	Product Data
265100	Interior Lighting	Operation / Maintenance Manual
265100	Interior Lighting	Warranty

END OF SECTION 013300

SECTION 013513.13 – SITE SECURITY AND HEALTH REQUIREMENTS (DESE)

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.

4. "No Asbestos and No Lead" certification.

5. Drug testing program and certification.

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.

3.2 RULES OF THE FACILITY

A. No alcohol, drugs, guns, or other weapons are permitted anywhere at the Facility (i.e., inside or outside buildings, or anywhere on school grounds); violators will be referred to local law enforcement for prosecution.

B. No tobacco or smoking products may be used anywhere at the Facility.

C. Sexual harassment, offensive or fraternizing behavior, or foul language around or towards students or staff will not be tolerated. Violations by workers will result in one warning from the Facility Representative. Subsequent infractions will require permanent ejection of offending worker(s) from the jobsite, with no change to the contract schedule or additional cost to the State.

D. The Contractor shall consider the safety of the Facility's students at all times, and shall maintain excavations, scaffolding/ladders, equipment, tools, and materials in as safe a manner as possible during and after working hours.

E. Vehicles should be locked and parked in areas designated by the Facility Representative.

F. Neither the Owner nor DESE assumes responsibility for the Contractor's vehicles, equipment, tools, or materials.

G. The Contractor shall coordinate and communicate planned daily work activities with the Facility Representative at least two (2) working days in advance. This will allow time for the Facility Representative to consider temporarily relocating special education students whose health could be adversely affected by loud noises, chemical odors, temperature extremes, etc.

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 will also check with law enforcement to determine if any of the Contractor's employees has an outstanding warrant for his or her arrest. FMDC reserves the right to prohibit any employee of the Contractor from performing work in or on the premises of any facility owned, operated, or utilized by the State of Missouri for any reason.

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 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 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 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 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. The Contractor's workers shall not be under the influence of any intoxicating substances while on the Facility premises.

3.5 NO ASBESTOS AND NO LEAD CERTIFICATION REQUIREMENTS

A. No asbestos containing material (> 1.0% asbestos by dry weight) or lead containing material (> 0.06% or 600ppm/10,000ppm lead by dry weight) shall be included in any project submittals or physically installed during construction work on this project.

B. USEPA regulations exclude local education agencies (i.e., DESE MSB, MSD, & SSSH) from the requirements of inspection, sampling, and analysis of homogenous areas that have been newly constructed or repaired/replaced in special education school buildings; where an Architect or Project Engineer responsible for the construction, or an Accredited Inspector, provides a signed statement that no asbestos (or lead) was specified, or used, as a building material (or system component) in any project construction documents, or physically installed as part of the project work. It is recommended that the Contractor research each material/component used on the job to verify that it contains no asbestos or lead (i.e., look at manufacturer's cut-sheet specifications, Material Safety Data Sheets, DOT shipping classification, or even contact the manufacturer for their verification); then, the Contractor should write on each project submittal: "To the best of my knowledge, items covered by this submittal contain no asbestos or lead containing material".

C. Contractor Certification Requirement

1. Prior to final payment, the Contractor shall submit a signed letter on company letterhead certifying that, to the best of its knowledge, no asbestos or lead containing materials were used or installed during the work. The Contractor shall address the letter to the Service Level Manager/ Designated Person for FMDC, at P.O. Box 809, Jefferson City, MO 65102, and (if applicable) to the Architect or Project Engineer. The letter shall reference the Site/Facility Name, Project Number, Project Title, and shall include the following statement:

"The Contractor certifies, to the best of its knowledge, that no asbestos containing material (> 1.0% asbestos by dry weight) or lead containing material (> 0.06% or 600ppm/10,000ppm lead by dry weight) was included in any project submittals or physically installed during construction work on this project. Contractor agrees to pay all costs incurred by the Owner discovering, abating, and/or restoring any component or portion of the work that is later found to include an asbestos or lead containing material in excess of these limitations."

D. Architect or Project Engineer Certification

1. As part of the final as-built/close-out document submittal requirements, it is requested that the Project Architect or Engineer (or Accredited Inspector as a last resort) responsible for design and submittal approval, submit a signed letter on company letterhead that references the Site/Facility Name, Project Number, Project Title, and includes the following statement:

"As the Designer, or Accredited Inspector, I certify, to the best of my knowledge, that no asbestos containing material (> 1.0% asbestos by dry weight) or lead containing material (> 0.06%, or, 600ppm/10,000ppm lead by dry weight) was specified in the construction documents, or approved for installation by the Contractor during construction work, on this project."

3.6 DRUG & ALCOHOL TESTING PROGRAM CONTRACTUAL REQUIREMENT - (1 CSR 30-7.010)

A. BASIS AND LEGAL REQUIREMENTS

1. In an effort to create safe and healthy schools and workplaces, the State of Missouri requires that Contractors and Subcontractors shall maintain and enforce a written substance abuse testing program for public works construction projects on public

and charter elementary and secondary education construction projects that are subject to the control of the State of Missouri. This policy is not intended to be a substitute for the Contractor's or Subcontractor's complete written substance abuse policy. These requirements shall be the minimum requirements for complying with Section 161.371, RSMo, and may be supplemented at the discretion of the Contractor or Subcontractor.

2. The State of Missouri has a vital interest in protecting the safety of students and maintaining safe, healthful, and efficient working conditions for both the state and its' Contractors' and Subcontractors' employees; and has determined that the educational and work environment is safer and more productive without the presence of illegal or inappropriate drugs, alcohol, or other substances in the body or on state property on which any state elementary or secondary school is located or being constructed or improved.

3. The use of illegal drugs, on or off duty, is inconsistent with law-abiding behavior expected of all persons. The use of illegal drugs, or abuse of alcohol or prescription drugs, may impair the ability of employees to perform tasks that are critical to proper work performance. The result is an increase in accidents and failures that pose a serious threat to the safety of all students, employees, visitors and the general public. Impaired employees also tend to be less productive, less reliable and prone to greater absenteeism, resulting in the potential for increased cost and delays in the timely completion of contracts.

B. CONTRACTUAL REQUIREMENTS

1. Each contract entered into for the performance of work on any public and charter elementary or secondary project subject to the control of the State of Missouri shall require that each Contractor and each Subcontractor have in place a drug and alcohol testing program consistent with this rule. These contractual requirements shall apply to Contractor and Subcontractor employees on public and charter elementary and secondary education construction projects that are subject to the control of the State of Missouri, including workers, new hires, replacements, and supervisory personnel. The Contractor and all Subcontractors shall comply with this contractual requirement. The State of Missouri shall determine, in its sole discretion, when this contractual requirement shall be applicable; and in such instances, any bid submitted in response to a request for proposal shall comply with this contractual requirement.

2. In order to be eligible to perform work on public and charter elementary and secondary education construction projects that are subject to the control by the State of Missouri, a Contractor must have and enforce a written drug and alcohol testing program incorporating the following testing requirements, terms and conditions applicable to all its employees, prospective employees and Subcontractors. Neither employee nor prospective employee of a Contractor or Subcontractor shall be permitted to work on public and charter elementary and secondary education construction projects that are subject to this rule unless such employee submits to testing as required by the contractual requirement required by this rule.

3. Each Contractor and Subcontractor subject to this rule shall train its' supervisory employees in methods that will allow them to recognize the signs and symptoms

of substance abuse and to take action provided by this contractual requirement in a manner consistent with generally accepted safety training procedures.

4. Each Contractor and Subcontractor subject to this rule is responsible for the cost of developing, implementing, and enforcing its drug and alcohol testing program, including the cost of drug and alcohol testing of its employees provided by the contractual requirement required by this rule.

5. Each Contractor shall furnish a copy of its drug and alcohol testing program and certify that it and its' Subcontractors are in compliance with the provisions of this rule to the State of Missouri at the time it submits a bid for any contract with the State of Missouri for work on public and charter elementary and secondary education construction projects that are subject to the control of the State of Missouri. Additionally, each Subcontractor shall furnish a copy of its substance abuse testing program to the Contractor prior to commencement of work on public and charter elementary and secondary education construction projects that are subject to this contractual requirement. The Contractor may reject a Subcontractor's program as noncompliant with the contractual requirement required by this rule.

C. TESTING REQUIREMENTS

1. PRE-ENGAGEMENT TESTING: Testing for all substances other than alcohol as described in this rule shall be conducted by each Contractor and Subcontractor for its employees or prospective employees within 120 days prior to any employee's appearance on a public and charter elementary and secondary education construction project that is subject to this contractual requirement. Contractors' or Subcontractors' employees that can provide certification of a previous drug test occurring within 120 days or employees that have been subject during the preceding consecutive two (2) years to a random and periodic selection program that meets the standards as set forth in this rule and, if the employee actually has been tested, that indicates a negative result for each of the substances listed herein, may be exempted from pre-engagement testing provided by this rule. If the employee was not employed by the Contractor or Subcontractor that is his or her current employer at the time of the previous test, the employee may be exempted from pre-engagement testing only upon certification of the non-negative test directly from the administrator of the testing program that conducted the previous test.

2. RANDOM TESTING: All employees of the Contractor and Subcontractor shall be subject to random testing by the Contractor or Subcontractor. For employees holding a commercial driver license, the annualized drug and alcohol testing rate shall comply with 49 CFR Part 382, as may be amended from time to time and similar applicable regulations of the Federal Highway Administration. All other employees of the Contractor or Subcontractor shall be subject to testing for all substances other than alcohol at the random annualized selection rate of fifty (50) percent of the Contractor's or Subcontractor's employees. Employees selected for random testing shall report in a timely manner to the drug and alcohol testing laboratory or collection site where directed for drug and/or alcohol testing.

3. PERIODIC TESTING: All employees working on public and charter elementary and secondary education construction projects that are subject to this rule shall be subject to periodic and random testing for all substances other than alcohol on at

least a biannual basis. Employees subject to periodic testing shall report in a timely manner as directed to the drug and alcohol testing laboratory or collection site for drug testing.

4. REASONABLE SUSPICION TESTING: All employees of the Contractor and Subcontractor on public and charter elementary and secondary education construction projects that are subject to this rule shall be subject to a drug and alcohol test when an employee is acting in an abnormal manner that leads a supervisory employee of the Contractor or Subcontractor to have reasonable suspicion that the employee is under the influence of alcohol or controlled substances. Reasonable suspicion means suspicion based on specific personal observations by the supervisory employee concerning the appearance, behavior, speech or breath odor of the employee.

5. POST-ACCIDENT/INCIDENT TESTING: All employees of Contractors and Subcontractors on public and charter elementary and secondary education construction projects who are subject to this rule shall be subject to a drug and alcohol test following an on-the-job injury requiring medical treatment or following a serious or potentially serious incident, including near misses, during which safety precautions were violated, persons were or could have been injured, unsafe instructions or orders were given, vehicles, equipment, or property was damaged, careless acts were performed, or when prescribed personal protective or safety equipment was not worn. Employees involved or who may have contributed to the incident, shall be subject to a drug and alcohol test. If it is impossible or impractical, because of the physical condition of the person involved in the accident to be subjected to drug and alcohol testing; and if in subsequent medical treatment, that person's blood or other bodily fluid will be drawn, then that blood or other bodily fluids may be analyzed for drugs and alcohol.

D. SUBSTANCE ABUSE TESTING PROTOCOLS

1. A Contractor or Subcontractor subject to the provisions of this rule shall perform pre-engagement, random, periodic, reasonable suspicion, and post accident/incident testing in the following manner:

a. Drug Testing

1) All urine samples collected under this program shall be analyzed by a laboratory certified by the National Institute on Drug Abuse/Substance Abuse and Mental Health Service Administration of the U.S. Department of Health and Human Services and shall include an initial Enzyme Multiplied Immunoassay Screening Test (EMIT) and, when necessary, confirmed by a Gas Chromatography /Mass Spectrometry (GC/MS) confirmation test. All samples confirmed by the laboratory as non-negative shall be interpreted as positive or negative by a Medical Review Officer licensed by the American Association of Medical Review Officers, American College of Occupational and Environmental Medicine, Medical Review Officer Certification Council, or American Society of Addiction Medicine.

b. Alcohol Testing

1) The initial screening tests for alcohol shall be performed by using either a saliva test or a DOT approved breathalyzer.
2) Alcohol confirmatory tests shall be performed by either a blood alcohol test or a DOT approved breathalyzer.

2. Testing for the presence of drugs or alcohol in an employee's system and the handling of test specimens shall be conducted in accordance with guidelines for laboratory testing procedures and chain-of-custody procedures established by the Substance Abuse and Mental Health Service Administration of the U.S. Department of Health and Human Services.

3. The program shall require notification to the employer and employee of the results of any non-negative drug and alcohol test and the Division of Facilities Management, Design and Construction shall be notified of the action taken to protect the safety of students as a result of such positive test, provided that no requirement of individual confidentiality of test results provided by federal law or regulation or state statute shall be violated in providing such notifications.

E. THRESHOLD LIMITS

1. All samples collected shall be analyzed by a laboratory certified by the Substance Abuse and Mental Health Service Administration of the U.S. Department of Health and Human Services, and shall include an initial Enzyme Multiplied Immunoassy Screening Test (EMIT) and, when necessary, confirmed by a Gas Chromatography/Mass Spectrometry (GC/MS) Confirmation Test. Said testing must screen, at a minimum, for the substances and levels of such substances provided by 49 CFR Part 40 and for alcohol as provided by 49 CFR Part 382, as may be amended from time to time. The levels that shall be deemed to result in a negative test result shall be defined by 49 CFR Part 40 and 49 CFR Part 382, as may be amended from time to time; provided that if such regulations shall no longer define substances and testing levels in the future, testing as required by this rule shall screen for the following substances that shall not exceed the following levels in order to be deemed a negative test result:

Drugs tested	(EMIT) Confirmed Initial Level (ng/ml)	Cut-Off Level (ng/ml)	(GC/MS) Confirmation Test
*Amphetamines	500	250	
Barbiturates	300	200	
Benzodiazepines	300	200	
Cocaine Metabolite	150	100	
Cannabinoids (Marijuana THC)	50	15	
Methadone	300	200	
Opiates:			
Codeine/Morphine	2000	2000	
Heroine Metabolite	10	10	
Phencyclidine (PCP)	25	25	
Propoxphene	300	200	
Breath/Blood Alcohol Content (BAC)	.04%	.04%	

Removal from jobsite (BAC)	.0200-.0399%	.0200%-.0399%

*Note – includes Amphetamines, Methamphetamines and Ecstasy (MDMA).

F. REFUSAL TO SUBMIT TO TESTING/CONFIRMED POSITIVE RESULTS

1. Any employee of a Contractor or Subcontractor performing any duties or work that are subject to this rule who refuses to submit to testing or receives a confirmed positive test result for any of the substances indicated in Section E shall be required to immediately leave the construction site and be prohibited from returning to any construction site subject to control of the State of Missouri until evidence is provided of the completion of the reinstatement procedures as set forth in section G.

2. Determination for Violation of Policy

a. A confirmed positive drug or alcohol test.

b. Failure to contact the Medical Review Officer as directed.

c. Failure to report as directed for random testing.

d. The use, possession, sale or distribution of alcohol or a controlled illegal or unauthorized substance, or the presence of any employee with such ingested substances for non-medical reasons on a public and charter elementary and secondary education construction project subject to the control of the State of Missouri.

e. Working, reporting to work, being on a public and charter elementary and secondary education construction project that is subject to the control of the State of Missouri, or in a state or employer owned, leased or rented vehicle, while under the influence of alcohol (0.04% BAC or greater).

f. Switching, adulterating or attempting to tamper with any sample submitted for drug or alcohol testing or otherwise interfering or attempting to interfere with the testing process.

g. Refusal to submit a specimen for testing shall be deemed to be a positive test result and shall be subject to the same consequences as specimens tested and confirmed as positive.

h. The use of a controlled substance by an individual other than the individual for whom the controlled substance was prescribed or the abuse of a controlled substance by the individual for whom it was prescribed.

G. REINSTATEMENT PROCEDURES

1. An employee receiving a confirmed positive test result for any of the substances indicated in Section 5 may return to work on a public and charter elementary and

secondary education construction project that is subject to the control of the State of Missouri only after the following conditions have been satisfied:

a. Evidence is submitted to the Contractor or Subcontractor that the employee has completed or is actively participating in an approved drug/alcohol assessment, treatment, and/or counseling program. The costs of this assessment, treatment or program need not be borne by the Contractor or Subcontractor.

b. Evidence is submitted of the employee passing of a drug and alcohol test that meets the requirements of Sections E and F of this rule. The costs of this subsequent retesting need not be borne by the Contractor or Subcontractor.

c. The employee shall be subject to additional random drug and alcohol testing on a monthly basis while on any public and charter elementary and secondary education construction project that is subject to the control of the State of Missouri. The costs of this additional testing, treatment or program need not be borne by the Contractor or Subcontractor.

d. An employee known by the Contractor or Subcontractor to have previously had a positive test result who receives a second or subsequent confirmed positive test result in connection with subsequent testing required by this Section H of this rule shall be removed by the Contractor or Subcontractor from all public and charter elementary and secondary education construction projects that are subject to the control of the State of Missouri. The employee shall not return to work on any public and charter elementary and secondary education construction project subject to this rule until that the employee has completed an approved drug/alcohol assessment, treatment, and/or counseling program; and until after evidence is submitted of the employee passing of a drug and alcohol test that meets the requirements of sections E and F of this rule and that indicates a blood alcohol concentration of less than 0.02 percent.

H. COMPLIANCE DETERMINATION

1. The State of Missouri may audit any substance abuse testing program implemented pursuant to this contractual requirement to verify compliance, upon at least 24 hours notice by the State to the Contractor of its intent to audit. The State shall have free access to all relevant records of the Contractor and its Subcontractors for this purpose.

2. Any portion of this program that is in violation of applicable federal or state law or regulation shall be deemed unenforceable.

3.7 DISRUPTION OF UTILITIES

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

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

END OF SECTION 01 35 13.13

SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for construction facilities and temporary control 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. Rodents and pest control
   9. Construction aids and miscellaneous services and facilities

D. Security and protection facilities include, but are not limited to, to following:
   1. Temporary fire protection
   2. Barricades, warnings 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 regulations
   2. Health and safety regulations
   3. Utility company regulations
   4. Police, fire departments, 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. Electric Service: If applicable, comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

D. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA Accessibility Guidelines.

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 barbed-wire top strand and 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 Contract Change.

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

C. Temporary Electric Power Service: 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 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.

F. Temporary Telephones: The Contractor will provide cell or telephone for use within the facility. All construction personnel will be allowed access only to those specific phones provided by the Contractor.

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

3.3 SUPPORT FACILITIES INSTALLATION

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

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

B. Field Offices: Separate outside unit not required. If field office space is required, Contractor to coordinate with Owner/Facility to designate a space within existing building, at the Pre-Construction Meeting.

C. Storage Facilities: Limited areas for storage of building materials are available onsite. The Contractor shall provide his own security. Specific locations for storage will be discussed at the Pre-Bid and the Pre-Construction Meetings.

D. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting. Under no circumstances will any vehicle be parked in a fire lane. Parking on lawns shall be prohibited.

E. 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.

F. 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.

G. 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.

H. 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.

I. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 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.

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

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

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

Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations".

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

C. 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.

D. 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, chain-link 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.

E. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Storage: Where materials and equipment must be stored and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

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

3.5 OPERATION, TERMINATION AND REMOVAL

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

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

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

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

1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances as required by the governing authority.

3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

a. Replace air filters and clean inside of ductwork and housing.

b. Replace significantly worn parts and parts subject to unusual operating conditions.

c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for product delivery, storage and handling.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment. Coordinate location with the Facility Representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017400 – CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 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 <once><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 017400

SECTION 017900 - 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 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 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.

1.2 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.

1.3 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 with starting and ending dates for each activity.

C. Predemolition photographs or video.

1.4 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.5 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.

G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

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/ASSP 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.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off utilities with utility companies.
   2. 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.
   3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings 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 and leave in place.
      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 and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

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. 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. Temporarily cover openings to remain.
   2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. 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 portable fire-suppression devices during flame-cutting operations.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Dispose of demolished items and materials promptly.

B. 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.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Store items in a secure area until delivery to Owner.
3. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Protect items from damage during transport and storage.
3. 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.

E. 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.

3.6 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. 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 024119

Section 028213 – ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 PROJECT/WORK IDENTIFICATION

A. General: The work specified herein shall be the abatement of asbestos containing materials by certified and registered persons who are knowledgeable, qualified and trained in the abatement, handling, and disposal of asbestos containing material, and subsequent cleaning of the affected environment.

B. The contractor shall supply all labor, materials, equipment, testing, services, permits, notifications, insurance, and incidentals which are necessary or required to perform the work in accordance with applicable local, state, and federal regulations as may be necessary for the abatement of asbestos containing materials and for other work as specified in this section or as indicated in associated drawings, sketches, or details of the work.

C. Scope of Work:

1. Abate/remove previously identified asbestos containing aircell pipe insulation and mudded fittings at the Missouri School for the Blind.

D. All abatement work areas must pass visual inspection as well as in-progress air-monitoring (by independent TPAM).

E. Owner's Construction Representative: Haley Coons, Oates Associates

1.2 LIST OF MATERIALS CONTAINING ASBESTOS (TO BE ABATED)

Material	Asbestos Content	Location	Total Quantity
Aircell Pipe Insulation	7% Chrysotile	Rooms 14-1653 (Pool), 14-1651 (Boys Locker Room), and 14-1654 (Girls Locker Room)	24 linear feet
Pipe Fittings	15% Chrysotile	Rooms 14-1653 (Pool), 14-1651 (Boys Locker Room), and 14-1654 (Girls Locker Room)	32 fittings

Note: Contractor is responsible for verifying all materials and quantities identified above prior to submitting their bid.

A copy of Occu-Tec's Asbestos Management Plan 2018 Reinspections Survey Report dated January 18, 2019 is attached for review.

1.3 TERMINOLOGY/DEFINITIONS/ABBREVIATIONS

A. Definitions:

1. Abatement: The Encapsulation, Enclosure and/or Removal of Asbestos Containing Materials (ACM). For Category I Non-friable ACM which will remain non-friable throughout disposal, abatement procedures will be modified and simplified as found within these and other applicable regulations.

2. Adequately Wet: To sufficiently mix or penetrate with liquid to prevent the release of particulates.

3. AHERA: Asbestos Hazard Emergency Response Act of 1966 (P.L. 99-519).

4. Aggressive Air Sampling: Sweeping of floors, ceilings and walls and other surfaces with the exhaust of a minimum of one horsepower leaf blower or equivalent immediately prior to air monitoring.

5. Air Sampling Professional: An individual, certified by the State of Missouri, who supervises air sampling activities during asbestos abatement projects.

6. Air Sampling Technician: An individual, under the supervision of an Air Sampling Professional, who performs air sampling during asbestos abatement projects.

7. Asbestos: The asbestiform varieties of serpentinite (chrysotile, antigorite), riebeckite (crocidolite), cummintonite-grumerite (amosite), anthophyllite, and actinolite-tremolite. For purposes of determining respiratory and worker protection both the asbestiform and non-asbestiform varieties of the above materials and any of these materials that have been chemically treated and/or altered shall be considered as asbestos.

8. Asbestos Abatement Project Designer: An individual, certified by the State of Missouri, who prepares plans and specifications for asbestos abatement projects.

9. Asbestos Abatement Supervisor: An individual, certified by the State of Missouri, who directs, controls, and/or supervises workers during an asbestos abatement project.

10. Asbestos Abatement Worker: An individual, certified by the State of Missouri, who performs asbestos abatement.

11. Asbestos-Containing Material (ACM): Any material or product which contains more than 1 percent asbestos by weight as determined by using the Polarized Light Microscopy method.

12. Asbestos-Containing Building Material (ACBM): Surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on building components.

13. Asbestos Containing Building Material (ACBM) Repair: The restoration of ACBM to an undamaged condition or to an intact state so as to prevent fiber release.

14. Asbestos-Containing Waste Material (ACWM): Any material to be removed from a work area for disposal that is an asbestos containing material (ACM) or is suspected of being contaminated with ACM.

15. Barrier: Any surface that seals off the work area to inhibit the movement of asbestos fibers.

16. Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches.

17. Category I Non-friable ACM: Asbestos-containing packings, gaskets, resilient floor covering and asphalt roofing products containing more than one percent (1%) asbestos as determined using the method specified in 40 CFR part 763, subpart F, Appendix A, section 1, Polarized Light Microscopy.

18. Category II Non-friable ACM: Any material, excluding category I non-friable ACM, containing more than one percent asbestos as determined using the methods specified in 40 CFR part 768, subpart F, Appendix A, section 1, Polarized Light Microscopy that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

19. Certified Industrial Hygienist (C.I.H.): An industrial hygienist, certified in Comprehensive Practice by the American Board of Industrial Hygiene.

20. Competent Person: An individual, capable of identifying existing asbestos hazards in the workplace and who has authority to take prompt corrective measures to eliminate them. His duties include: establishing the negative-pressure enclosure, ensuring its integrity, and controlling entry to and exit from the enclosure; supervising any employee exposure monitoring; ensuring that all employees working within such an enclosure wear the appropriate personal protective equipment, are trained in the use of appropriate methods of exposure control, and in the use of hygiene facilities and decontamination procedures; and ensuring that engineering controls in use are in proper operating condition and are functioning properly. An individual who has been certified by the State of Missouri as an Asbestos Abatement Supervisor is considered a “Competent Person”.

21. Owner’s Construction Representative: An employee of the Division of Design and Construction representing the Director during the construction phase of the contract commencing at Notice of Award.

22. Containment: Area where asbestos abatement project is conducted. Area must be enclosed either by a glove bag or plastic sheeting barriers.

23. Critical Barrier: Plastic sheeting or other material to be placed over Work Area openings (i.e., windows, HVAC supply and return vents, doors, electrical fixtures, etc.).

24. Decontamination Facility: The serial arrangement of rooms or spaces for the purpose of separating the work site from the building environment upon entering the Work Area and for the cleaning of persons, equipment and contained waste prior to returning to the clean environment.

25. Disposal Bag: A properly labeled 6 mil. thick leak-tight clear plastic bag used for transporting asbestos waste from work site and to the disposal site.

26. Encapsulant (Sealant): A liquid material which can be applied to asbestos-containing material and which prevents the release of asbestos fibers from the ACM either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the ACM and binding its components together (penetrating encapsulant) or is specifically designed to minimize fiber release during removal of ACM (removal encapsulant).

27. Encapsulation: Treatment of asbestos-containing materials with an encapsulant.

28. Enclosure: The construction of an airtight, impact resistant barrier to isolate a surface coated with ACM.

29. Friable: Any material which when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

30. Glove Bag: A manufactured or fabricated device, typically constructed of six mil transparent polyethylene or polyvinyl chloride plastic. This device consists of two inward projecting long sleeves, an internal tool pouch and an attached, labeled receptacle for asbestos waste.

31. Initial Exposure Assessment: Is a required assessment to be performed by the Contractor's Competent Person (Asbestos Abatement Supervisor) concerning the exposure potential of a specific asbestos projects, or series of similar asbestos projects. If it is concluded that the employee exposures during the project are likely to be consistently below the Permissible Exposure Limit, the Contractor establishes a Negative Initial Exposure Assessment.

32. Outside Air: Air outside containment.

33. Permissible Exposure Limit (PEL): Eight-hour time weighted average of 0.1 fibers/cubic centimeter.

34. Personal Monitoring: Sampling of the asbestos fiber concentrations within the Breathing Zone.

35. Regulated Asbestos-Containing Material (RACM): Friable asbestos material; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; or Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

36. Removal: To take out or eliminate ACM from building components, materials, substrates.

37. Third Party Air Monitor (TPAM): The Air Sampling Professional who conducts air monitoring in who is not under the direct control of the abatement contractor and who has been selected by the owner.

38. Visible Emission: Any discharge of an air contaminant into the atmosphere that is visually detectable without the aid of instruments.

39. Work Area: A specific room or physically isolated portion of a room, other than the space enclosed within a glove bag, in which friable asbestos-containing material is required to be handled in accordance with current federal and state regulations. The area is designated as a work area from the time that the room, or portion of it, is secured and access restrictions are in place. The area remains designated as a work area until the time that it has been cleaned in accordance with any requirements applicable to the operations conducted.

B. Abbreviations:

1. AIA: American Institute of Architects

2. AIHA: American Industrial Hygiene Association

3. MDNR: Missouri Department of Natural Resources

4. DEQ: Division of Environmental Quality, MDNR

5. DOT: U. S. Department of Transportation

6. EPA: U. S. Environmental Protection Agency

7. MDH: Missouri Department of Health

8. NIOSH: National Institute for Occupational Safety and Health

9. NVLAP: National Voluntary Laboratory Accreditation Program

10. OSHA: Occupational Safety and Health Administration, U. S. Department of Labor.

11. TPAM: Third Party Air Monitor

1.4 SUMMARY OF REQUIREMENTS:

A. All work performed on this project shall be done in the strictest accordance with applicable federal, state and local regulations, standards and codes governing asbestos abatement and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.

B. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among requirements or these specifications exists, the most stringent requirements shall be utilized.

C. Because asbestos exposure is a serious health hazard, construction work involving any asbestos-containing materials is regulated by the Occupational Safety and Health Administration Regulations. Compliance with OSHA regulations in the completion of this project is the **sole** responsibility of the contractor. OSHA regulations include, but are not

limited to, conducting appropriate negative exposure assessments and/or daily personnel air monitoring. However, the following requirements will apply regardless of the removal methods to be employed:

1. Regardless of the removal methods employed, the contractor shall immediately stop work in the event of any of the following:

    a. Visible Emissions (as defined in this document), or
    b. Sanding, grinding, cutting abrading, removal by open flame, or
    c. Breathing Zone air samples exceed the PEL or Excursion Limit; furthermore, the contractor shall implement corrective work practices upon the approval of the Asbestos Abatement Project Designer, make re-notification to all regulatory agencies of the changes in work practices and material conditions, and comply with all referenced regulations in this document and the applicable sections of this specification as noted.

2. If any of the conditions in subparagraph e above are observed by the Owner's Construction Representative or by the Third-Party Air Monitor (TPAM), then either of these parties has the right to issue a directive to stop work. The Contractor shall be obligated to implement corrective action. The contractor shall not be entitled to additional compensation.

D. FRIABLE ACM. This scope of work includes the removal of Friable ACM and therefore, all applicable federal, state and local requirements, including notifications, should be followed.

1. Make notifications in compliance with Section 2.1 of this specification.

2. Remove and dispose of all asbestos containing materials in compliance with the federal and state regulations as listed, but not necessarily limited to, those under Section 4.0 of this specification.

1.5 PROJECT COORDINATION

A. Contractor shall coordinate and schedule all phases of the work of the contract documents under his control with the Owner's Construction Representative, Facility Representative, any subcontractors, materials suppliers, and other parties involved as necessary to ensure the smooth and orderly transition of separate phases, timely placement of items and materials, cooperation between parties, and proper execution of the work. **Contractor must give the TPAM at least two business days' notice of start of work or change of work schedule. The contractor will be required to reimburse the State of Missouri for hours TPAM worked and for their expenses if the TPAM mobilizes and abatement work has been canceled, delayed, or postponed for that day.**

B. All coordination necessary with the facility will be made through the Facility Representative or their designated representative. The Owner's Construction Representative and Facility Representative prior to the start of any work will approve scheduling and access to the work areas.

C. Normal working hours of the facility will be observed in performing the work unless the Facility Representative and Owner's Construction Representative approves the modification as addressed in the Special Conditions.

D. Contractor shall not communicate with any news or media outlets. Any news media inquiries or releases shall be directed to the Facilities Management Design and Construction Division at (573) 751-3339.

E. The contractor, project superintendent, subcontractors, and other appropriate parties shall attend meetings as scheduled and as otherwise necessary to accomplish the work in a timely and efficient manner. Meetings shall include but are not limited to the following:

1. Pre-Construction Meeting: The Owner's Construction Representative may schedule a pre-construction meeting after the Notice of Award has been issued. The Owner's Construction Representative will determine the date, time, and exact place of this meeting and all necessary parties will be notified, if need be. During the meeting, discussions will be held in regard to construction procedures, scheduling requirements, general conditions, special conditions, channels of communication, responsible persons, requirements for submittals, documentation requirements, payment applications, and other pertinent information necessary for completing the work. Specific requirements of the facility in regard to security, safety, utilities, access to buildings, and related matters will also be discussed.

2. If, in the opinion of the Owner's Construction Representative, additional meetings are required to maintain progress or scheduling requirements on the work, additional meetings will be scheduled.

F. All fees required for notification requirements, re-notifications, and/or inspections by the Department of Natural Resources and all other federal, state, or local agencies shall be paid by the contractor. If necessary, bulk samples analysis information required in conjunction with the notification to the Missouri Department of Natural Resources, U. S. Environmental Protection Agency or city having jurisdiction shall be provided by the contractor unless provided within this specification.

G. Should the project fall behind schedule the abatement contractor is expected to take such steps, as necessary, to complete the project on time. The contractor will be entitled to no additional compensation for implementation of such steps to maintain the work schedule.

PART 2 - EXECUTION

2.1 NOTIFICATIONS

A. Should the material being removed amount to more than 10 square feet, 16 linear feet or 3 cubic feet, notification shall be completed and sent by the contractor not less than ten (10) day before the intended start date of the project. Use City of St. Louis form "Asbestos NESHAP Notification of Demolition and Renovation and the St. Louis City form "Asbestos Project Notification", to all applicable federal, state, and local agencies, including but not limited to those listed below. **Draft copies of all notifications shall be submitted to the Consultant at least 3 days prior to being submitted to the regulatory agencies.**

1. City of St. Louis Department of Health
   Air Pollution Control
   1520 Market Street, Room 4051
   St. Louis, MO 63103

2. Provide copies of these notifications to the Owner's Construction Representative, with the Facilities Management Design and Construction Division as well as SCI Engineering.

2.2 SUBMITTALS

A. The following submittals will be required of the contractor prior to commencement of work and are subject to approval by the Owner's Construction Representative. The contractor shall send one copy of the submittals for approval to the Owner's Construction Representative.

1. Copy of Material Safety Data Sheets (MSDS) for each product to be used by the contractor in the performance of his work. Contractor will also maintain copies of the MSDS on site, per OSHA.

2. A copy of the courtesy notifications to regulatory agencies as required in Section 2.1 of this specification.

3. Current training certificates and MDNR licenses for project superintendent, asbestos abatement supervisor(s), and asbestos workers. Superintendent shall meet the qualifications established in Section 3.8 of these specifications.

4. Name, address, and contact person's name of testing laboratory or laboratories to be utilized by the contractor (this is <u>not</u> the TPAM) in analyzing samples for bulk analysis or air monitoring from taking personal air samples. Required by OSHA.

5. Provide a detailed work schedule with milestones for the completion of the project within the established timeframe.

6. Provide a disposal plan to detail the types of disposal containers to be used, the methods of transportation to the disposal site, the waste hauler, and disposal site.

7. Copies of notifications required as part of the emergency notification plan in Section 3.6 of this specification.

B. Upon completion of the work and prior to final payment, the following information must be submitted to the Owner's Construction Representative.

1. Waste disposal receipts and waste shipment record on all asbestos waste removed from the project. The enclosed Waste Shipment Record and Receipt form (or something similar) must be used for every load brought to the waste disposal site. The disposal and/or shipment record <u>must</u> include the following information:

   a. Work site name and address
   b. Project Number
   c. Owner's name and telephone

d. Operator's (Contractor's) name, address and telephone
e. Waste Disposal Site name, address and telephone
f. Name and address of responsible agency
g. Type of materials and quantity in cubic yards or tons.
h. Name, address and phone number of transporter, and date of transport
i. Name, address and phone number of Waste Disposal Site representative and date material was received.

2. Air monitoring test results from all air samples taken by the TPAM during abatement, to include area, in progress and personal tests. Results must be written in final report form.

3. Written certification from the TPAM as required in Section 3.7 of this specification.

4. Any other specific requirements spelled out in the General Conditions.

2.3 TESTING LABORATORY

A. Testing laboratories utilized by the contractor for OSHA required sample analysis during the project shall meet the following minimum requirements:

1. For bulk sample analysis, the laboratory must be accredited by the National Voluntary Laboratory Accreditation Program for asbestos fiber analysis.

2. For air samples analyzed by Phase Contrast Microscopy, the laboratory must be accredited by the American Industrial Hygiene Association.

3. For air samples analyzed by Transmission Electron Microscopy, the laboratory must be accredited by the National Voluntary Laboratory Accreditation Program.

4. On-site analysis by Phase Contrast Microscopy, when applicable, shall be by an Air Sampling Technician or Air Sampling Professional who has completed a NIOSH 582 course or equivalent.

5. Neither the contractor, nor any of his principals, officers, or directors may have any financial or business interests in any laboratory utilized on this contract.

2.4 LOCAL AREA PROTECTION/SITE SECURITY

A. The contractor shall be responsible for all areas of the building used by him and/or subcontractors in the performance of the work. He shall exert full control over the actions of all employees and subcontractors with respect to the use and preservation of the existing building, except such controls as may be specifically reserved to the owner by these specifications.

B. The contractor has the right to exclude from the work area all persons who have no purpose related to the work or its inspection and shall require all persons in the work area to observe the same regulations as he requires his employees.

C. The contractor shall have control of site security during abatement operations in order to protect his work and equipment. He will have the owner's assistance in notifying building occupants of impending activity and enforcement of restricted access by owner's employees.

D. The contractor shall keep, as a minimum, two 10-pound type ABC fire extinguishers on site at all times. One extinguisher will be maintained outside the work area and one inside the work area. The contractor's employees shall be trained in the use and operation of the extinguishers.

E. The contractor shall use as small an area as necessary for storage of supplies and equipment and shall keep such in a neat and orderly fashion.

F. Contractor is prohibited from entering portions of the building not required for completion of their scope of work.

G. The contractor shall maintain the work area free from rubbish, debris, and dirt and keep a clean safe work area. The contractor shall take measures to keep surfaces free from contamination or shall clean and lock down surfaces after work is done, protect with plastic sheeting and/or plywood during work, or remove from the work area. Trash must be removed daily and will not be allowed to accumulate.

H. Contractor is responsible for all damage to the structure other than that required for the removal of the ACMs. At the conclusion of the project, the contractor must repair such incidental damage including tape and glue residue, paint coatings and damage to surfaces, finishes and building components.

I. No signage, equipment or materials shall be placed or stored outside the work area.

2.5 WORKER PROTECTION/TRAINING

A. The contractor shall be responsible for providing his employees with proper respiratory protection, respiratory training, a written respirator program, medical examinations, protective clothing and equipment and for maintaining medical records to comply with OSHA requirements.

B. The contractor shall be responsible for all testing and costs incurred for complying with requirements OSHA regulations for Personal Monitoring.

C. All workers are to be trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and protective measures.

2.6 EMERGENCY PROTECTION PLAN

A. The contractor shall be responsible for developing a written site-specific Emergency Protection Plan and shall maintain this plan on site. The plan shall include considerations for asbestos leakage from site, fire, explosion, toxic atmospheres, electrical hazards, slips, falls, and heat related injury. All employees shall be instructed and trained in the procedures.

B. Emergency protection planning shall also include written notification of police, fire, and medical personnel of the planned abatement activities, work schedule, and the layout of the work area, particularly barriers that may affect response capabilities.

2.7 THIRD PARTY AIR MONITORING

A. The Owner will contract with an Air Sampling Professional to perform the following minimum duties:

1. Review Contractor's work plan and provide recommendations.

2. If a containment is required, at a minimum, during abatement operations, at least three samples daily shall be collected outside the work area at locations of barriers separating the work areas from other portions of the building. One sample shall be required at the decontamination entrance to the area.

3. If in-progress samples are necessary, at a minimum, during abatement operations, at least two samples daily shall be collected surrounding the abatement operations.

4. Samples shall be analyzed by PCM. Any result above the OSHA PEL of 0.1 f/cc (8 hr TWA), or EL of 1.0 f/cc (30 min TWA) must be immediately reported to the Construction Administrator and cause operations to cease and corrective measures be taken.

5. Provide Construction Administrator with daily abatement reports describing amount and type of work done, regulatory concerns, notable air monitoring reports, etc.

6. A visual inspection of the work area will be conducted prior to clearance.

7. Certify that the contractor's procedures, methods, and practices were in full compliance with current federal or state regulations, using the Appendix A form "TPAM Statement of Compliance".

B. The TPAM must be independent from the abatement contractor.

2.8 SUPERINTENDENCE OF ABATEMENT

A. The contractor shall designate an abatement superintendent, who will serve as the contractor's representative on the project and will ensure that all work is performed in compliance with all applicable regulations and following minimum requirements:

1. The Abatement Superintendent must be certified as an Asbestos Abatement Supervisor and must have at least one-year full-time experience in asbestos abatement work.

2. Shall be on site whenever work is going on.

3. Maintain a daily log documenting project events, visitations/inspections, problems, and accidents.

4. Implement first aid, safety training, respiratory protection, and ensure workers are trained in emergency procedures.

5. Conduct visual inspection of the work area prior to TPAM's final clearance inspection. This inspection shall be documented.

6. Supervise activities of any subcontractors of the contractor to ensure compliance with contract documents.

7. Duties shall include those for the "Competent Person" as defined in this specification.

8. Superintendent must have a cellular telephone when at the project site and the contact information for the supervisor provided to the construction manager and TPAM.

2.9 FINAL CLEARANCE REQUIREMENTS

A. All critical barriers and/or containment must remain in place until work area is cleared by TPAM and Construction Manager in accordance with this section.

B. The TPAM, in addition to the requirements listed in Section 3.7 TPAM, will collect samples outside the work area to determine the effectiveness of work practices and control measures used by the contractor to contain asbestos fibers inside the work area. The TPAM will determine the number, frequency and location of the samples.

C. Following the completion of the abatement work, the abatement superintendent shall notify the Construction Administrator. The superintendent shall then perform a visual inspection of the work area. If satisfactory, he shall contact the TPAM. The TPAM shall perform a visual inspection and final air monitoring for clearance if he/she feels the abatement has been completed.

D. Aggressive air sampling shall be performed by the TPAM in areas where floor tile will be abated. In-progress/area samples will be used as clearance samples where glove bag removal is performed.

E. All clearance samples will be analyzed, at a minimum, by the PCM (NIOSH 7400) method, unless specifically stated elsewhere within this specification. The TPAM shall take a minimum of 5 samples inside each affected workspace (or one per room whichever is greater), 1 field blank and 1 sealed blank. The abatement shall be considered complete when the result of each of 5 inside clearance samples indicate airborne fiber (> 0.25 um dia. x 5 um L) concentrations are no greater than the PCM limit of quantitation of 0.01 f/cc of air. Test results should be made available to the contractor within 24 hours.

F. In the event that in-progress air sampling is conducted, these samples shall act as final clearance samples. As stated above, these in-progress final clearance samples shall be considered complete when the result of each sample indicate airborne fiber concentrations are no greater than the PCM limit of quantitation of 0.01 f/cc of air. Test results should be made available to the contractor within 24 hours.

G. If the NIOSH 7400 PCM clearance sampling method fails, then the TEM method 7402 may be utilized to further evaluate the air sample(s) that exceed 0.01 f/cc. The TPAM will be responsible for determining if a failing PCM sample will be analyzed by TEM 7402.

H. Any work areas failing to meet the clearance requirements of this section shall be re-cleaned and re-tested at the contractor's expense until satisfactory levels are obtained. The owner will not reimburse the contractor for re-cleaning the work area. The TPAM will separate their costs for the re-testing from their already agreed upon services. The owner will deduct, by contract change, the cost of the TPAM's retesting activities including any lab fees, travel and re-inspection and/or air monitoring fees from the contractor's contract amount.

2.10 RE-ESTABLISHMENT OF THE WORK AREA AND SYSTEMS

A. Re-establishment of the work area shall only occur after the contractor has complied with the clearance requirements of Section 2.9. All barriers, signs, trash, and equipment shall then be removed from the site. All electrical and HVAC systems shall be re-established.

B. All damage to finishes, equipment, and/or the area affected by the abatement shall be repaired by the contractor to equal or better condition as was prior to the work, at no cost to the owner.

2.11 WASTE DISPOSAL

A. All Asbestos Containing Waste Material (ACWM) shall be disposed of in compliance with current federal and state regulations.

B. ACM shall be disposed of in a Missouri licensed demolition landfill or a sanitary landfill having a state permit to operate and accept such waste.

C. A chain of custody letter/waste shipment record and disposal receipts shall be provided to the owner for all materials disposed of.

D. The waste shipment record shall be originated and signed by the waste generator and shall be used to track and substantiate the disposition of ACWM.

2.12 DRAWINGS

A. For the purpose of this specification, drawings, when provided, are not intended to be used for anything other than a “reference” to the work area. Information is not specific to quantities or to the exact location of ACM. The contractor is required to field verify the conditions, locations, and quantities referenced.

3.0 CODES AND REGULATIONS

A. This section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of this specification.

B. Requirements include adherence to work practices and procedures set forth in applicable codes, regulations and standards.

C. General Applicability of Codes, Regulations and Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations standards, statutes, laws and rules have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith. In the event of conflicting applicable codes, regulations, standards, statutes, laws, or rules, the more stringent shall apply to these specifications.

D. Contractor Responsibility: The contractor shall assume full responsibility and liability for compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state, and local regulations. The contractor shall hold the owner harmless for failure to comply with any applicable work, hauling, disposal, safety, health, record keeping or other regulation on the part of himself, his employees, or his subcontractors.

E. Requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

1. U. S. Department of Labor, Occupational Safety and Health Administration (OSHA) including but not limited to:

    a. Title 20, Part 1910, Section 1001 and Part 1926, Section 58 of the Code of Federal Regulations.
    b. Respiratory Protection, Title 29, Part 1910, Section 134 of the Code of Federal Regulations.
    c. Construction Industry, Title 29, Part 1926, of the Code of Federal Regulations.
    d. Access to Employee Exposure and Medical Records, Title, 29, Part 1910, Section 2 of the Code of Federal Regulations.
    e. Hazard Communication, Title 29, Part 1910, Section 1200 of the Code of Federal Regulations.
    f. Specifications for Accident prevention Signs and Tags, Title 29, Part 1910, Section 145 of the Code of Federal Regulations.

2. U. S. Environmental Protection Agency (EPA) including but not limited to:

    a. National Emission Standards for Hazardous Air Pollutants (NESHAPS) Title 40, Part 61, Subpart M of the Code of Federal Regulations.
    b. Asbestos Hazard Emergency Response Act (AHERA), Public Law (99-519) applicable only on schools.
    c. Asbestos-Containing Materials in Schools: Title 40, Part 763 of the Code of Federal Regulations, applicable only on schools.

3. U. S. Department of Transportation (DOT)

    a. Title 49, Part 172, Section 101 of the Code of Federal Regulations.

4. State of Missouri

   a. H.B. 77, 85th General Assembly.
   b. Missouri Air Conservation Law, Chapter 643.
   c. Due to a recent court decision, the following Code of State Regulations do not apply to this specification:
      1) 10 CSR 10-6.020, Definitions
      2) 10 CSR 10-6.080, Emission Standards for Hazardous Air Pollutants.
      3) 10 CSR 10-6.230, Administrative Penalties
      4) 10 CSR 10-6.240, Asbestos Abatement Projects-Registration, Notification and Performance Requirements.
      5) 10 CSR 10-6.250, Asbestos Abatement Projects - Certification, Accreditation, and Business Exemption Requirements.

END OF SECTION

SECTION 028333 –PAINT REMOVAL, HANDLING AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. General: Various lead-based paint (LBP) demolition and/or paint preparations needed as part of renovation/demolition activities. LBP demolition and/or preparation will include all the gray ceramic tile walls within the girl's locker room and the red concrete steps in the pump room as a part of the upcoming renovation project. All work shall be performed in accordance with the Environmental Protection Agency's Renovation, Repair and Painting (RRP) Program.

B. The Contractor shall supply all labor, materials, equipment, services, permits, notifications, insurance, and incidentals which are necessary or required to perform the work in accordance with applicable local, state, and federal regulations for the Scope of work detail herein.

C. All work must pass a final visual clearance performed by SCI Engineering, Inc. or the Construction Manager.

D. Third party environmental oversight will be performed by SCI engineering, Inc. (SCI).

E. Third party oversight: Jessica Keeven, CHMM, SCI Engineering, Inc (314) 267-7129.

F. All work must be performed by a Contractor and with a crew who have been trained in accordance with the EPAs RRP Program.

1.2 SUMMARY OF RENOVATION ACTIVITIES

A. The purpose of the renovation activities it to perform repairs to the swimming pool. The gray ceramic walls within the girl's' locker room, which has subsequently been identified as being lead-based, shall be demolished. The red painted concrete steps to the pump room is in poor condition and may be impacted by the removal and replacement of the existing pool equipment. All work must be performed by a Contractor and with a crew who have been trained in accordance with the EPAs RRP Program and shall implement dust control measures prior to beginning work. All waste generated from this project shall be properly characterized, containerized, transported and disposed of in accordance with the applicable local, state and federal regulations.

The Contractor is responsible for verifying all field conditions and quantities prior to submitting their bid.

The requirements outlined within this section apply to the gray ceramic wall tile in the girl's locker room as well as the red paint on the concrete steps to the pump room.

1.3 TERMINOLOGY/DEFINITIONS/ABBREVIATIONS

A. Definitions:

1. Administrative Control: Written policies prepared before work begins which remove or prevent exposure to physical, biological, or chemical hazards.

2. Air Sampling Professional: An individual who by qualifications and experience is proficient in air monitoring and possesses a valid Missouri Certification and License.

3. Approved Waste Disposal Site: A solid waste disposal area that is authorized by the Department of Natural Resources to receive lead-based paint containing solid wastes.

4. Barrier: An envelope or containment that seals off the work area to inhibit the movement of particulate and dust particles.

5. Biological Monitoring: The analysis of a person's blood and/or urine, to determine the level of lead contamination in the body.

6. CFR: The Code of Federal Regulations, in the basic component of the Federal Register publication system. The CFR is a codification of the regulations of the various Federal Agencies.

7. Characteristics: The EPA has identified four characteristics of a hazardous waste: Ignitability; Corrosivity; Reactivity and Toxicity. Any solid waste that exhibits one or more of these characteristics is classified as a hazardous waste under RCRA.

8. Container: Any portable device, in which material is stored, transported, treated, disposed of, or otherwise handled.

9. Containment: A process for protecting both workers and the environment by controlling exposures to lead dust and debris created during renovation.

10. Contingency Plan: A document setting out an organized, planned, and coordinated course of action to be followed in case of a fire or explosion or a release of hazardous waste or hazardous waste constituents from the project site or a treatment, storage, or disposal facility that could threaten human health or the environment.

11. Contractor: Any business entity, public unit, or person, certified and licensed to conduct business in the State of Missouri and the employee have the EPA RRP training.

12. Discharge or Hazardous Waste Discharge: The accidental or intentional spilling, leaking, pumping, pouring, emitting, discharge emptying, or dumping of hazardous wastes onto any land or water or into the air.

13. Disposal Bag: A properly labeled 6 mil thick leak-tight plastic bag used for transporting waste from the work area to the disposal site.

14. Disposal Facility: A facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water, and at which the waste will remain after closure.

15. EPA Identification Number: The unique number assigned by EPA to each generator or transporter of hazardous waste, and each treatment, storage, or disposal facility.

16. Exposure Monitoring: The personal air monitoring of an employee's Breathing Zone to determine the amount of contaminant (e.g. lead) to which he/she is exposed.

17. Federal Register: A document published daily by the federal government that contains either proposed or final regulations.

18. Generator: Any person who first creates a hazardous waste, or any person who first makes the waste subject to the Subtitle C regulation (e.g., imports a hazardous waste, initiates a shipment of a hazardous waste from a TSD, or mixes hazardous wastes of different DOT shipping descriptions by placing them into a single container).

19. Hazardous Waste: As defined in RCRA the term "hazardous waste" means a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

    a. Cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
    b. Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

    As defined in the regulations a solid waste is hazardous if it meets one of four conditions:

        1) Exhibits a characteristic of a hazardous waste (40 CFR Sections 261.20 through 262.24).
        2) Has been listed as hazardous (40 CFR Section 261.31 through 261.33).
        3) Is a mixture containing a listed hazardous waste and a non-hazardous solid waste (unless the mixture is specifically excluded or no longer exhibits any of the characteristics of hazardous waste)?
        4) Is not excluded from regulations as a hazardous waste?

20. Landfill: A disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a land treatment facility, a surface impoundment, or an injection well.

21. Lead-Based Paint: Any surface coating (paint, varnish, shellac, etc.) that contains more than 600 parts per million (.06% by weight) as defined by the Consumer Products Safety Commission. Lead-based paint is 1 milligram of lead per square centimeter (1.0 mg/cm² as measured by XRF) or has a weight of 5,000 parts per million (.5% by weight) as defined by HUD.

22. Lead (inorganic), Pb: An element, which means that its atomic structure is permanently arranged and is not changed by chemical reactions. Lead can combine chemically with other atoms or molecules to make new compounds. Lead is considered a heavy metal: "heavy," because lead weighs much more than the same volume of water, and "metal," because when it is refined from raw ore into its pure form, lead can be hammered or drawn into shapes.

23. Listed: Hazardous wastes that have been placed on one of three lists developed by EPA: Non- specific source wastes; specific source wastes; commercial chemical products. These lists were developed by examining different types of waste and chemical products to see if they exhibit one of the four characteristics, meet the statutory definition of hazardous waste, are acutely toxic or acutely hazardous, or are otherwise toxic.

24. Manifest: The shipping document, EPA form 8700-22, used for identifying the quantity, composition, origin, routing, and destination of hazardous waste during its transportation from the point of generation to the point of treatment, storage, or disposal.

25. Owner: The State of Missouri.

26. Pattern: The process of identifying specific building components containing lead-based paint at a hazardous level within a project or group of buildings.

27. Permissible Exposure Limit or PEL: The highest average amount of lead that you are allowed to breathe over an 8-hour period. The OSHA PEL for General Construction is 50 ug/m3.

28. Personal Samples: (for sampling lead dust) - Air samples collected from within the Breathing Zone of a worker, but outside the respirator. The samples are collected with a personal sampling pump, pulling 1 to 4 liters/minute of air.

29. Project Manager: An employee of the Division of Facilities Management, Design and Construction, representing the Director during the length of the project.

30. RCRA: Resource Conservation and Recovery Act of 1976. An amendment to the Solid Waste Disposal Act of 1965. RCRA was amended in 1980 and most recently on November 8, 1984 by Hazardous and Solid Waste Amendments.

31. Regulation or Rule: All or part of any Federal statement of general or particular applicability and future effect designed to: (1) implement, interpret, or prescribe law or policy, or, (2) describe the Federal Department's organization or its procedures or practice requirements.

32. Representative Sample: A sample of a universe or whole (e.g., waste sample pile, lagoon, ground water, or waste stream) which can be expected to exhibit the average properties of the universe or whole.

33. Site: The land or water area where any facility is physically located or conducted, including adjacent land used in connection with the facility or activity.

34. Solid Waste: As defined in RCRA the term "solid waste" means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under the Clean Water Act, or special nuclear or byproduct material as defined by the Atomic Energy Act of 1954.

35. Storage: The holding of hazardous waste for a temporary period, at the end of which time the hazardous waste is treated, disposed of, or stored elsewhere.

36. Substrate: A surface upon which a finish material (paint, etc.) has been or may be applied. Examples of substrates include wood, plaster, metal, and drywall.

37. Toxic Characteristic Leaching Procedure or TCLP: A test designed to identify wastes likely to leach hazardous concentrations of particular toxic constituents into the ground water as a result of improper management. This test provides the determination of whether a solid waste is classified as a hazardous substance.

38. Toxicity: A characteristic of hazardous waste as measured by the TCLP.

39. Transporter: Any person engaged in the off-site transportation of hazardous waste within the United States, by air, rail, highway, or water, if such transportation requires a manifest under 40 CFR Part 262.

40. Treatment: Any method, technique or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize it, or render it non-hazardous or less hazardous, or to recover it, make it safer to transport, store or dispose of, or amenable for recovery, storage, or volume reduction.

41. TSD: A treatment, storage, or disposal hazardous waste facility.

42. Waste Disposal Site: A solid waste disposal area that is authorized by the Missouri Department of Natural Resources to receive lead containing solid waste.

43. Waste Shipment Record: The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of lead containing waste material.

B. Abbreviations:

ASTM: American Society for Testing and Materials.

DNR: Missouri Department of Natural Resources, 10 CSR 25 – Hazardous Waste Management. 260.350 – 260.575 – RSMo.

DHSS: Missouri Department of Health & Senior Services – Lead Poisoning Prevention.

DOT: U.S. Department of Transportation

EPA: U.S. Environmental Protection Agency

FMDC: Missouri Division of Facilities Management, Design & Construction

NIOSH: National Institute for Occupational Safety and Health

NVLAP: National Voluntary Laboratory Accreditation Program

OSHA: Occupational Safety and Health Administration, U.S. Department of Labor

RRP: Remove Replace Paint

1.4 SUMMARY OF REQUIREMENTS

A. All work performed on this project shall be done in the strictest accordance with applicable federal, state and local regulations, standards and codes governing the demolition activities described in this scope of work. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.

B. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among requirements or these specifications exists, the most stringent requirements shall be utilized.

C. Because ingestion or inhalation of lead containing dust is a serious health hazard, construction work involving lead-based paint is regulated by the Occupational Safety and Health Administration Regulations. Compliance with OSHA regulations in the completion of this project is the sole responsibility of the Contractor. OSHA regulations include, but are not limited to conducting daily personnel air monitoring. However, the following requirements will apply regardless of the removal methods to be employed:

1. Regardless of the removal methods employed, the Contractor shall immediately stop work in the event of any of the following:

   a) Visible Emissions.

   b) Breathing Zone air samples exceed the PEL or Excursion Limit; furthermore, the Contractor shall implement corrective work practices, upon the approval of the owner and TPAM, make re-notification to all regulatory agencies of the changes in work

practices and material conditions, and comply with all referenced regulations in this document and the applicable sections of this specification as noted.

2. If any of the conditions in subparagraph "a" above are observed by the Construction Administrator or by the TPAM, then either of these parties has the right to issue a directive to stop work. The Contractor shall be obligated to implement corrective action. The Contractor shall not be entitled to additional compensation.

D. Lead-Based Paint: This scope of work includes the removal of paint which has been identified as being lead-based paint, and therefore all applicable federal, state, and local requirements, including notifications, should be followed. This demolition is being performed as an RRP project; therefore, notification to the Missouri Department of Health and Senior Services (DHSS) will not be required.

1. Make notifications in compliance with Section 2.1 of this specification.

2. Dispose of all paint shall be performed in compliance with the federal and state regulations as listed but not necessarily limited to those under section 4.0 of this specification. It is the Contractor's responsibility to perform all necessary testing if the waste will not be handled and disposed of a hazardous waste.

1.5 PROJECT COORDINATION

A. Contractor shall coordinate and schedule all phases of the work of the contract documents under his control with the Construction Administrator, Facility Representative, any subcontractors, materials suppliers, and other parties involved as necessary to ensure the smooth and orderly transition of separate phases, timely placement of items and materials, cooperation between parties, and proper execution of the work. Contractor must give SCI at least two business days' notice of start of work or change of work schedule. The Contractor will be required to reimburse the State of Missouri for hours SCI worked and for their expenses if SCI mobilizes and work has been canceled, delayed, or postponed for that day.

B. All coordination necessary with the facility will be made through the Facility Representative or their designated representative. The Construction Administrator and Facility Representative prior to the start of any work will approve scheduling and access to the work areas.

C. Normal working hours of the facility will be observed in performing the work unless the Facility Representative and Construction Administrator approve the modification as addressed prior to project beginning.

D. Contractor shall coordinate any news media inquiries or releases with the facilities Management Design and Construction Division at (573) 751-3339.

E. The Contractor, project superintendent, subcontractors, and other appropriate parties shall attend meetings as scheduled and as otherwise necessary to accomplish the work in a timely and efficient manner. Meetings may include, but are not limited to, the following:

1. Pre-Construction Meeting: the Construction Administrator will schedule the pre-construction meeting after the Notice of Award has been issued. The Construction Administrator will determine the date, time, and exact place of this meeting and all necessary parties will be notified. During the meeting, discussions will be held in regard to construction procedures, scheduling requirements, general conditions, special conditions, channels of communication, responsible persons, requirements for submittals, documentation requirements, payment applications, and other pertinent information necessary for completing the work. Specific requirements of the facility in regard to security, safety, utilities, access to buildings, and related matters will also be discussed.

2. If, in the opinion of the Construction Administrator, additional meetings are required to maintain progress or scheduling requirements on the work, additional meetings will be scheduled.

F. All fees required for notification requirements, re-notifications, and/or inspections by the applicable local, state or federal agencies shall be paid by the Contractor.

PART 2 - EXECUTION

2.1 NOTIFICATIONS

A. This project will be performed as an RRP interior demolition project; therefore, notification to the Missouri DHSS will not be required as this is not a lead abatement project.

B. The Contractor is responsible for notifications, and associated fees) to other local, state or federal agencies (i.e. construction permits, etc.)

2.2 SUBMITTALS

A. The following items are required to be submitted by the Contractor prior to the commencement of work and are subject to approval by SCI. The Contractor shall send one copy of the submittals for approval and then send approved copies of the submittals to the distribution list as discussed at the Pre- Construction Conference.

1. Proof of EPA RRP training for the individuals that may disturb the painted surfaces.

2. Provide a disposal plan to detail the types of disposal containers to be used, the methods of transportation to the disposal site, the waste hauler, and disposal site.

B. Prior to final acceptance of the project, the following items must be submitted to the Contractor Administrator:

1. Waste Disposal Receipts: The waste transporter’s manifest and the landfill receipts on all lead containing waste removed from the project.

2. Close-out documentation required by the General Conditions, i.e., certified payrolls, Final Receipt of Payment and Release Form, Compliance with Prevailing Wage Affidavit and MBE/WBE reports.

C. Upon completion of the work and prior to final payment, the following information must be submitted to the Construction Administrator.

1. Waste disposal receipts and waste shipment records on all lead waste removed from the project. The Waste Shipment Record and Receipt form (or something similar) must be used for every load brought to the waste disposal site. The disposal and/or shipment record must include the following information:

a) Work site name and address;
b) Project Number;
c) Owner's name and telephone;
d) Operator's (Contractor's) name, address and telephone;
e) Waste Disposal Site name, address and telephone;
f) Name and address of responsible agency;
g) Type of materials and quantity in cubic yards or tons;
h) Name, address and phone number of transporter, and date of transport; and
i) Name, address and phone number of Waste Disposal Site representative and date material was received.

2. Any other specific requirements spelled out in the General Conditions.

2.3 DRAWINGS

A. For the purpose of this specification, drawings, when provided, are not intended to be used for anything other than a "reference" to the work area. Information is not specific to quantities or to the exact location of paint to be removed. The Contractor is required to field verify the conditions, locations, and quantities referenced.

SCI's Limited Lead Based Paint Inspection dated June 22, 2022 is attached which includes field sketches as well as photographic documentation of the lead-bearing coatings.

2.4 LOCAL AREA PROTECTION/SITE SECURITY

A. The Contractor shall be responsible for all areas of the building used by him and/or subcontractors in the performance of the work. He shall exert full control over the actions of all employees and subcontractors with respect to the use and preservation of the existing building, except such controls as may be specifically reserved to the owner by these specifications.

B. The Contractor has the right to exclude from the work area all persons who have no purpose related to the work or its inspection and shall require all persons in the work area to observe the same regulations as he requires his employees.

C. The Contractor shall have control of site security during renovation in order to protect his work and equipment. He will have the owner's assistance in notifying building occupants of impending activity and enforcement of restricted access by owner's employees.

D. The Contractor shall keep, as a minimum, two 10-pound type ABC fire extinguishers on site at all times. One extinguisher will be maintained outside the work area and one inside the work area. The Contractor's employees shall be trained in the use and operation of the extinguishers.

E. The Contractor shall use as small an area as necessary for storage of supplies and equipment and shall keep such in a neat and orderly fashion.

F. Access to emergency exits, stairways, emergency disconnects (i.e. fire suppressant, electrical, plumbing, etc.), and all other important building systems must remain unrestricted during the project. The Contractor must submit a written request to the Facility Representative if their work (i.e. dust barriers, equipment, etc.). will limit access to the building or important building systems.

G. Contractor is prohibited from entering portions of the building not required for completion of their scope of work.

H. The Contractor must secure access into the work area to prevent public entrance. The Contractor should post warning tape and install warning signs at each door leading to the work area. All signage should be kept within the office suite.

I. The Contractor shall maintain the work area free from rubbish, debris, and dirt and keep a clean safe work area. The Contractor shall take measures to keep surfaces free from contamination or shall clean and lock down surfaces after work is done, protect with plastic sheeting and/or plywood during work, or remove from the work area. Trash must be removed daily and will not be allowed to accumulate.

J. Contractor is responsible for all damage to the structure other than that required to complete the scope of work outlined herein. At the conclusion of the project, the Contractor must repair such incidental damage including tape and glue residue, paint coatings and damage to surfaces, finishes and building components.

K. All signage, equipment and material shall be kept within the office suite.

2.5 WORKER PROTECTION/TRAINING

A. The Contractor shall be responsible for providing his employees with proper respiratory protection, respiratory training, a written respirator program, medical examinations, protective clothing and equipment and for maintaining medical records to comply with OSHA requirements.

B. The Contractor shall be responsible for all testing and costs incurred for complying with requirements OSHA regulations for personal monitoring, including but not limited to, all applicable air and blood sampling.

C. All workers are to be trained in the dangers inherent in handling lead containing materials, breathing lead dust, and in proper work procedures and personal and protective measures.

D. All work must be performed by individuals who have been trained in accordance with the EPAs RRP Program.

2.6 EMERGENCY PROTECTION PLAN

A. The Contractor shall be responsible for developing a written site-specific Emergency Protection Plan and shall maintain this plan on site. The plan shall include considerations for fire, explosion, toxic atmospheres, electrical hazards, slips, falls, and heat related injury. All employees shall be instructed and trained in the procedures. The plan shall also include contact information for local emergency personnel including the police, fire, and medical services and the nearest hospital/emergency medical treatment facility.

2.7 PROJECT SUPERINTENDENT

A. The Contractor shall designate a project superintendent, who will serve as the Contractor's representative on the project and will ensure that all work is performed in compliance with all applicable regulations and following minimum requirements:

1. The Superintendent and crew must be trained in accordance with the Environmental Protection Agency's Renovation, Repair and Painting (RRP) Program and must have at least one -year full-time experience in working with lead-based paint.

2. Shall be on site whenever work is going on.

3. Maintain a daily log documenting project events, visitations/inspections, problems, and accidents.

4. Implement first aid, safety training, respiratory protection, and ensure workers are trained in emergency procedures.

5. Conduct visual inspection of the work area prior to the final, third party, inspection. This inspection shall be documented.

6. Supervise activities of any subcontractors of the Contractor to ensure compliance with contract documents.

2.8 THIRD PARTY AIR MONITORING

A. The Owner will contract with an environmental consultant, SCI Engineering, Inc. to perform the following minimum duties:

1. Review Contractor's work plan and provide third party recommendations;

2. Collect air samples periodically (if deemed necessary) during the RRP renovation project. Air samples shall be analyzed by NIOSH methods 7105, 7082, or 7300;

3. Provide Construction Administrator with periodic project reports describing amount and type of work done and other project concerns;

4. A visual inspection of the work area will be conducted prior to final RRP renovation clearance;

5. Review Contractor's disposal documentation;

6. Laboratories shall be accredited by ELLAP (AIHA – Environmental Lead Laboratory Accreditation Program) and NLLAP (EPA – National Lead Laboratory Accreditation Program); and

7. Neither the Contractor, nor any of its principals, officers, or directors may have any financial or business interests in any laboratory utilized on this contract.

2.9 FINAL CLEARANCE REQUIREMENTS

A. The work area, including all equipment, dust barriers must remain in place and operational until work area is cleared by SCI and the Construction Manager in accordance with this section.

B. Following the completion of the renovation work, the project superintendent shall notify the Construction Administrator. The superintendent shall then perform a visual inspection of the work area. If satisfactory, they shall contact SCI. SCI shall then perform a visual inspection if they feel the work has been completed.

C. Demolition activities are not considered to be complete until the visual clearance is acceptable.

2.10 RE-ESTABLISHMENT OF THE WORK AREA AND SYSTEMS

A. Re-establishment of the work area shall only occur after the Contractor has complied with the clearance requirements of Section 2.9. Once the project's clearance criteria have been met, the Contractor may remove barriers, signs, trash, and equipment from the site.

B. The entire area shall be cleaned, using a HEPA vacuum and wet wiping, as a final step to the renovation process.

C. All damage to finishes, equipment, and/or the area affected by the renovation shall be repaired by the Contractor to equal or better condition as was prior to the work, at no cost to the owner.

2.11 WASTE DISPOSAL

A. The lead containing debris/paint should be treated as a hazardous waste unless the Contractor performs the appropriate and applicable TCLP analysis to suggest otherwise. Representative sampling should be performed in accordance with all applicable local, state, and federal regulations. If the Contractor chooses to collect a representative sample of all lead containing debris for a TCLP analysis, the sample locations should be clearly marked. Note that if performed, the TCLP analysis should be performed not

only for lead, but for all eight RCRA heavy metals. If the waste does not exceed the regulatory threshold for hazardous waste, the waste may be treated as special waste and disposed in a sanitary landfill, following the applicable local, state of federal regulations.

2.12 CODES AND REGULATIONS

A. This section sets forth governmental regulations and industry standards, which are included and incorporated herein by reference and made a part of this specification.

B. Requirements include adherence to work practices and procedures set forth in applicable codes, regulations and standards.

C. General Applicability of Codes, Regulations and Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations standards, statutes, laws and rules have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith. In the event of conflicting applicable codes, regulations, standards, statutes, laws, or rules, the more stringent shall apply to these specifications.

D. Contractor Responsibility: The Contractor shall assume full responsibility and liability for compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state, and local regulations. The Contractor shall hold the owner harmless for failure to comply with any applicable work, hauling, disposal, safety, health, record keeping or other regulation on the part of himself, his employees, or his subcontractors.

END OF SECTION 028333

033000 CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

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

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, bent bar diagrams, bar arrangement, splices and laps, and supports for concrete reinforcement.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer and testing agency.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.

4. Waterstops.
5. Curing compounds.
6. Bonding agents.
7. Adhesives.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

C. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

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

1. ACI 301, "Specifications for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Testing Service: Contractor shall engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
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, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

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

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

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

1. ACI 301 (ACI 301M).

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 1064/A 1064M:

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

2.4 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.
2. Fly Ash: ASTM C 618, Class F or C.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1-inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Water: ASTM C 94/C 94M and potable.

2.5 CURING MATERIALS

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

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

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, according to ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).

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

B. Cementitious Materials:

1. Fly Ash: 25 percent maximum.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.8 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Minimum Cementitious Materials Content: 540 lb/cu. yd. (320 kg/cu. m).
4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (19-mm) nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.2 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

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

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.3 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

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

3.4 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).

C. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

D. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

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, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

E. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.5 FINISHING FLOORS AND SLABS

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

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.6 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.7 CONCRETE PROTECTING AND CURING

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

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

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. Cure concrete according to ACI 308.1, 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. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.8 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

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

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

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.9 FIELD QUALITY CONTROL

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

B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. All items included in the General Notes on Sheet S-001 and in Section 1705.3 of the IBC.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

10. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2) Intertek Group in its "Directory of Listed Building Products."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Hilti, Inc.
    b. Specified Technologies, Inc. (STI)
    c. 3M Fire Protection Products.
    d. Approved Equivalent

B. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

C. For large openings and complex penetrations made to accommodate cable trays and bundles, FIREBLOCKS shall be used to allow removal and reassembly of the system as required for new cabling and maintenance.

D. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

E. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

F. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

G. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

H. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

I. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by

penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:
    a. Slag-wool-fiber or rock-wool-fiber insulation.
    b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
    d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate

proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Latex joint sealants.
2. Silicone joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Field-adhesion-test reports.

C. Sample warranties.

1.4 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.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealants: To match adjacent wall finishes.

2.2 LATEX JOINT SEALANTS

A. Acrylic Latex sealant

1. Adfast, Adseal 1072 series
2. Tremco Tremflex 834 Siliconized Acrylic Latex Sealant.
3. Or Approved Equal.

B. Acrylic Latex Firestop Sealant

1. Tremco Tremstop Acrylic
2. Or Approved Equal.

2.3 SILICONE JOINT SEALANTS

A. Silicone, Neutral one-part silicone sealant.

1. Adfast, Adseal 4580 series
2. Dow Corning 758 Silicone Weather Barrier Sealant.
3. Or Approved Equal.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

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

a. Adfast.
b. Pecora Corporation.
c. The Dow Chemical Company.
d. Tremco Incorporated.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Adfast, Adseal BR-4600 Soft Polyethylene Backer Rod
2. Construction Foam Products; a division of Nomaco, Inc.
3. Master Builders Solutions.
4. Or Approved Equal.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 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.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 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 laitance and form-release agents from concrete.
2. 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.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

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

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install 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.

E. 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. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.3 JOINT-SEALANT SCHEDULE

A. Adfast, Adseal 4800 series: For sealing of nonporous surfaces around showers, tubs, sinks and plumbing fixtures where conditions of high humidity and temperature extremes exist.

1. Typical applications include:

a. Sealing around shower-tub enclosures, tubs, sinks, urinals and whir
b. Sealing around bathroom fixtures
c. Waterproofing rimless sinks
d. Ceramic tile grouting

2. Color: As selected from Manufacturer’s standard line.

B. Adfast, Adseal 1072: For general purpose interior caulking, and as an acoustical seal in the construction of interior walls, ceilings and floors.

1. Color: As selected from Manufacturer’s standard line.

C. Tremco, Inc., Tremsil 200 Sanitary: 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 Color: As selected by Architect from manufacturer's full range of colors.

D. Tremco Tremstop: For use in firestop applications, including both joints and through-penetrations. Sealant is for use on metal pipe, plastic pipe, insulated pipe, cables, cable trays, ducts, static joints and dynamic joints in fire-rated concrete, wood floor/ceiling and gypsum wall assemblies and can also be used on acoustically rated assemblies.

1. Color: As selected from Manufacturer’s standard line.

a. Concealed Conditions: Rust red at fire-rated assemblies; Limestone at non-rated assemblies.
b. Exposed Conditions: Custom color to match adjacent surface.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. 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.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Field quality control reports.

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; AADG, Inc.; ASSA ABLOY.
2. Curries, AADG, Inc.; ASSA ABLOY Group.
3. Mesker Door; Mesker Openings Group.

2.2 INTERIOR STANDARD STEEL DOORS AND FRAMES

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

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B..

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
d. Edge Construction: Model 1, Full Flush.
e. Core: Manufacturer's standard.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
b. Construction: Full profile welded.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).

3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.4 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 A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.5 FABRICATION

A. Door 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.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. 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 welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

3. 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.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with post-installed 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.

4. Solidly pack mineral-fiber insulation inside frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
6. 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.
7. Installation Tolerances: Adjust hollow-metal frames 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.

B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 06 Section “Rough Carpentry”
3. Division 06 Section "Finish Carpentry”
4. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:

    a. “Metal Doors and Frames”
    b. “Flush Wood Doors”
    c. “Stile and Rail Wood Doors”
    d. “Interior Aluminum Doors and Frames”
    e. "Aluminum-Framed Entrances and Storefronts"
    f. “Stainless Steel Doors and Frames”
    g. “Special Function Doors”
    h. "Entrances”

6. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
7. Division 26 “Electrical” sections for connections to electrical power system and for low-voltage wiring.
8. Division 28 “Electronic Safety and Security” sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies

4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:

a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

a. Wiring Diagrams: For power, signal, and control wiring and including:
1) Details of interface of electrified door hardware and building safety and security systems.
2) Schematic diagram of systems that interface with electrified door hardware.
3) Point-to-point wiring.
4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

    a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

    a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
    b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
    c. Indicate complete designations of each item required for each opening, include:
        1) Door Index: door number, heading number, and Architect's hardware set number.
        2) Quantity, type, style, function, size, and finish of each hardware item.
        3) Name and manufacturer of each item.
        4) Fastenings and other pertinent information.
        5) Location of each hardware set cross-referenced to indications on Drawings.
        6) Explanation of all abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for hardware.
        8) Door and frame sizes and materials.
        9) Degree of door swing and handing.
        10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

    a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
    b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

    a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    b. Catalog pages for each product.
    c. Final approved hardware schedule edited to reflect conditions as installed.
    d. Final keying schedule
    e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
    f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:

    a. fire door assemblies, in compliance with NFPA 80.
    b. required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: 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 meets these requirements:

    a. For door hardware: DHI certified AHC or DHC.
    b. Can provide installation and technical data to Architect and other related subcontractors.
    c. Can inspect and verify components are in working order upon completion of installation.
    d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:

    a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
    b. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:

    a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
    b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware

a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

a. Comply with governing accessibility regulations cited in “REFERENCES” article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
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.

2. Pre-installation Conference

a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
b. Inspect and discuss preparatory work performed by other trades.
c. Inspect and discuss electrical roughing-in for electrified door hardware.
d. Review sequence of operation for each type of electrified door hardware.
e. Review required testing, inspecting, and certifying procedures.
f. Review questions or concerns related to proper installation and adjustment of door hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer’s original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop 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.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer’s published listings.

a. Mechanical Warranty
1) Locks
a) 10 year
2) Closers
a) 30 year

b. Electrical Warranty
1) Locks
a) 1 year

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: “No Substitute.”

1. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Ives 5BB series

2. Acceptable Manufacturers and Products:

a. Hager BB1191/1279 series
b. McKinney TB series
c. Stanley FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:

a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

a. Steel Hinges: Steel pins
b. Non-Ferrous Hinges: Stainless steel pins
c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins

e. Interior Non-lockable Doors: Non-rising pins

10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.03 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Schlage ND series

2. Acceptable Manufacturers and Products:

a. Sargent 11-Line
b. Corbin-Russwin CL3100 series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

a. Lever Design: Rhodes

2.04 ELECTRONIC ACCESS CONTROL LOCKSETS

A. Manufacturers:

1. Scheduled Manufacturer and Product:

a. Schlage CO Series

2. Acceptable Manufacturers and Products:

a. No Substitute

B. Requirements:

1. Provide offline electronic access control products that comply with the following requirements:

a. Listed, UL 294 - The Standard of Safety for Access Control System Units.
b. Compliant with ANSI/BHMA A156.25 Grade 1 Operation and Security.

c. Certified to UL10C, FCC Part15, Florida Building Code Standards TAS 201 large missile impact, TAS 202 and TAS 203.
d. Compliant with ASTM E330 for door assemblies.
e. Compliant with ICC / ANSI A117.1, NFPA 101, NFPA 80, and Industry Canada RSS-210.

2. Functions: Provide functions as scheduled that are field configurable without taking the offline electronic product off the door.
3. Emergency Override: Provide mechanical key override; cylinders: Refer to “KEYING” article, herein.
4. Levers:

a. Vandal Resistance: Exterior (secure side) lever rotates freely while door remains locked, preventing damage to internal lock components from vandalism by excessive force.
b. Provide pressure cast zinc plated, non-handed lever trim that operates independently of non-locking levers.

5. Power Supply: 4 AA batteries

a. Provide electronic access control locks and/or exit device trim with the ability to communicate battery status.

6. Features:

a. Visual tri-colored LED indicators that indicate activation, operational systems status, system error conditions and low power conditions.
b. Visual bi-colored LED indicator on interior that can indicate secured/unsecured status of device to occupants on interior.
c. Audible feedback that can be enabled or disabled.
d. Onboard processor with memory capacity of 2,000 event audit history, up to 16 time zones and up to 32 calendar events.
e. Central verification time of less than 1 second
f. Tamper-Resistant Screws: Tamper torx screws on inside escutcheon for increased security.

2.05 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. LCN 4040XP series

2. Acceptable Manufacturers and Products:

a. Corbin-Russwin DC8000 series
b. Sargent 281 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.

3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 5/8-inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.06 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Rockwood
c. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, 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. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing doors and frames for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

    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: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

J. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer’s instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier’s responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

Hardware Group No. 01

For use on Door #(s):
14-1651D-2
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-CY-70-KP-RHO-J 4B BATTERY OPERATED	✓	626	SCE
1	EA	FSIC CORE	PERMANENT CORE		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC		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 HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION
PROGRAMMABLE CLASSROOM LOCK - LOCKSET NORMALLY SECURE. INSIDE LEVER ALWAYS ALLOWS FREE EGRESS. VALID TOGGLE CREDENTIALS ON THE EXTERIOR MAY BE USED TO MOMENTARILY UNLOCK DOOR OR CHANGE TO A PASSAGE OR SECURED STATUS.
SELF CLOSING.

Hardware Group No. 02

For use on Door #(s):
14-1645C-2
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	GASKETING	488SBK PSA	BK	ZER

OPERATIONAL DESCRIPTION
PRIVACY LOCK - PUSH-BUTTON LOCKING. WHEN LOCKED, CAN BE OPENED FROM OUTSIDE WITH SMALL SCREWDRIVER. TURNING INSIDE LEVER OR CLOSING DOOR RELEASES BUTTON. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.
OVERHEAD STOP

Hardware Group No. 03

For use on Door #(s):
14-1645C-1
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	FSIC CORE	CONST/DISP CORE	622	SCH
1	EA	FSIC CORE	PERMANENT CORE	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER HM	SR64	GRY	IVE

OPERATIONAL DESCRIPTION
STOREROOM LOCK - OUTSIDE LEVER FIXED. ENTRANCE BY KEY ONLY. INSIDE LEVER ALWAYS UNLOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

Hardware Group No. 04

For use on Door #(s):
14-1651D-1
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

OPERATIONAL DESCRIPTION
FREE EGRESS AND ENTRY AT ALL TIMES BY PUSH PLATE OR PULL. NON-LOCKING, NON-LATCHING.
SELF CLOSING.

END OF SECTION

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

1.3 INFORMATIONAL SUBMITTALS

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

B. Evaluation reports for embossed, high-strength steel studs and tracks, post-installed anchors and power-actuated fasteners.

PART 2 - PRODUCTS

2.1 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 AISI S220 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated
2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40 (Z120); or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.

a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

C. Studs and Track: AISI S220.

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. CEMCO; California Expanded Metal Products Co.
b. ClarkDietrich.
c. Marino\WARE.
d. Phillips Manufacturing Co.

2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
3. Depth: As indicated on Drawings.

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

1. Single Long-Leg Track System: ASTM C645 top track with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Hat-Shaped, Rigid Furring Channels: ASTM C645.

1. Minimum Base-Steel Thickness: 0.0296 inch (0.752 mm).
2. Depth: 7/8 inch (22.2 mm).

F. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
1. Configuration: hat shaped.

2.2 AUXILIARY MATERIALS

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

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

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

2.3 SUSPENSION SYSTEM

A. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong Ceiling & Wall Solutions.
b. Certainteed; SAINT-GOBAIN.
c. Rockfon; ROCKWOOL International.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 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.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install 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.

E. Direct Furring:

1. 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. 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.

3.3 INSTALLING CEILING SUSPENSION

A. 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.

B. 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 092216

SECTION 092300 - GYPSUM PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gypsum plastering on masonry and concrete.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Bonding Compound: ASTM C631.

C. Fasteners for Attaching Metal Lath to Substrates: ASTM C841.

D. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter unless otherwise indicated.

E. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

F. Mix Additives: Use gypsum plaster accelerators and retarders from plaster manufacturer if required by Project conditions. Use only additives that manufacturer recommends in writing for use with plaster to which it is added.

2.2 BASE-COAT PLASTER MATERIALS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 15 percent.

B. Lightweight-Gypsum Ready-Mixed Plaster: ASTM C28/C28M, with mill-mixed perlite aggregate.

1. CertainTeed Corporation.
2. USG
3. National Gypsum Company.
4. Or Approved Equal

C. Gypsum Neat Plaster: ASTM C28/C28M, for use with job-mixed aggregates.

1. CertainTeed Corporation.
2. USG
3. National Gypsum Company.
4. Or Approved Equal

D. Aggregates for Base-Coat Plasters: ASTM C35, sand and perlite.

2.3 FINISH-COAT PLASTER MATERIALS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 15 percent.

B. Gypsum Gaging Plaster: ASTM C28/C28M.

1. Manufacturer: Same as base coat.

C. Gypsum Ready-Mixed Finish Plaster: Manufacturer's standard, mill-mixed, gaged, interior finish.

1. Manufacturer: Same as base coat.

D. Lime: ASTM C206, Type N, normal finishing hydrated lime.

E. Aggregates for Float Finishes: ASTM C35, sand; graded according to ASTM C842.

2.4 PLASTER MIXES

A. Mixing: Comply with ASTM C842 and manufacturer's written instructions for applications indicated.

B. Mix Additives: Use accelerators and retarders, if required by Project conditions, according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Sound-Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

B. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.2 PLASTER APPLICATION

A. General: Comply with ASTM C842.

B. Bonding Compound: Apply on masonry and concrete substrates for direct application of plaster.

C. Base-Coat Plaster:

1. Over Masonry: Lightweight-gypsum ready-mixed plaster or Gypsum neat plaster with job-mixed sand.
2. Over Monolithic Concrete: Gypsum neat plaster with job-mixed sand.

D. Finish Coats:

1. Smooth-Troweled Finishes: Gypsum gaging plaster and lime putty or Gypsum ready-mixed finish plaster.
2. Float Finishes: Gypsum gaging plaster and lime putty.

3.3 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

END OF SECTION 092300

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data:
1. Gypsum board, Type X.
2. Mold-resistant gypsum board.
3. Glass-mat, water-resistant backing board.
4. Cementitious backer units.
5. Interior trim.
6. Joint treatment materials.
7. Sound-attenuation blankets.
8. Acoustical sealant.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Samples: For each texture finish indicated on same backing indicated for Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 15 percent.

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

2.3 INTERIOR GYPSUM BOARD

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

1. American Gypsum.
2. Certainteed; SAINT-GOBAIN.
3. Georgia-Pacific Gypsum LLC.
4. National Gypsum.
5. USG Corporation.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

B. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Thickness: As indicated.
2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or plastic.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Verify adhesives have a VOC content of 50 g/L or less.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: As specified in Section 079200 "Joint Sealants."

1. Verify sealant has a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.1 INSTALLATION AND FINISHING OF PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

E. Prefill open joints and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

5. Level 5: Where indicated on Drawings.

a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

H. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

I. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Tile backing panels.
3. Waterproofing membranes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Laboratory Test Reports: For sealers, indicating compliance with requirements for low-emitting materials.

C. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.
3. Stone thresholds.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer has minimum 5-years' experience installing ceramic tile products.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Wall Tile:

1. Provide products as indicated on drawings by manufacturer's designations.
2. Size: As indicated on drawings
3. Pattern /Orientation: As indicated on drawings.
4. Color / Finish: As indicated on drawings.

B. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

1. Base: As indicated on drawings.

2.2 SURFACE PREPRATION MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. MAPEI: Basis-of-Design Manufacturer.
2. Acceptable Manufacturers.
   a. Custom Building Products.
   b. Laticrete.

B. Trowelable Floor/Wall Patch and Render Mortar: Quick-setting, polymer-modified, fiber-reinforced, cementitious rendering, patching, ramping and leveling mortar, can be applied from 1/8 inch to 1-1/4 inches (3 mm to 3.2 cm).

1. Product: MAPEI, Planitop 330 Fast.

C. Concrete Repair Patch: Premixed cement-based mortar for concrete repairs, fast-setting, high compressive strength, can be applied at 1/4 inch to 4 inches (6 mm to 10 cm).

1. Product: MAPEI, Mapecem Premix.

D. Patching Compound: Fast-setting, polymer-modified patching compound, cement-based, high compressive strength, can be applied up to 1/2 inch (12 mm) with water, or 1/4 inch (6 mm) when mixed with diluted MAPEI, Planipatch Plus.

1. Product: MAPEI, Planipatch.

E. Skimcoating Compound: High-performance, polymer-modified, fiber-reinforced, cement-based, skimcoating and patching compound, can be applied at featheredge up to 1 inch (2.5 cm).

1. Product: MAPEI, Planiprep SC.

F. Gypsum-Based Patching Compound: Repair minor holes, voids and depressions in concrete, gypsum-based surfaces or wood underlayments, and holes in drywall and plaster walls, can be applied up to 1/2 inch (12 mm).

1. Product: MAPEI, Planitex UNS.

2.3 WATERPROOF MEMBRANES

A. General: Manufacturer's standard product that complies with ANSI A118.10 and ANSI A118.12,and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

1. Product: Subject to compliance with requirements, provide MAPEI materials.

B. Fluid-Applied Membrane: Advanced liquid-rubber, extremely quick-drying, premium waterproofing and crack-isolation membrane, IAPMO-listed, ANSI A118.10 and ANSI A118.12.

1. Product: MAPEI, Mapelastic AquaDefense.
   a. With MAPEI, Reinforcing Fabric.

2.4 ADHESIVES AND PRIMERS

A. Multipurpose Bond-Promoting Primer: Low-VOC, synthetic resin-based primer with bond-promoting silica aggregates suspended in a dispersion, for interior and exterior applications.

1. Product: MAPEI, ECO Prim Grip.

B. All-Purpose Primer: Low-odor, water-based acrylic primer for self-leveling underlayments, also suitable for a wide variety of porous and nonporous substrates.

1. Product: MAPEI, Primer T.

C. Concrete Primer: Advanced-technology, low-odor, low-VOC, acrylic latex primer for concrete, gypsum-based underlayments and patches.

1. Product: MAPEI, Primer L.

D. Epoxy Primer: High-performance, 100%-solids epoxy primer, low-odor, VOC-compliant (requires sand broadcast).

1. Product: MAPEI, Primer E.

E. Consolidating Epoxy Primer: Ultra low-viscosity, consolidating, for weak concrete or gypsum substrates, 100%-solids epoxy primer.

1. Product: MAPEI, Primer CE.

F. Metal/Concrete/Wood Bonding Agent/Primer: Two-component, multipurpose, high-modulus, nonshrink, 100%-solids and moisture-tolerant epoxy bonding agent.

1. Product: MAPEI, Planibond EBA with sand broadcast.

G. Two-Component Reactive Adhesive: Excellent for bonding to properly prepared steel and plywood substrates, white, flexible, interior and exterior, floors and walls, trowelable, two-component adhesive, suitable for most types of ceramic tile, moisture-sensitive tile, natural stone, and agglomerates, ISO 13007 R2.

1. Product: MAPEI, Planicrete W.

H. Hybrid-Polymer-Based Adhesive for Gauged Porcelain Tile and Gauged Porcelain Tile Panels/Slabs: Single-component, non-sag performance with panels, instant grab and holding power, easy-to-trowel, moisture-cure and hybrid-polymer-based adhesive technology.

1. Product: MAPEI, Ultrabond ECO GPT.

2.5 SETTING MATERIALS

A. Improved Modified Dry-Set Cement Mortar, Non-Sag, for Large and Heavy Tile with High-Transfer Technology: ANSI A118.4HTE, ANSI A118.11, and ISO 13007 C2TE.

1. Product: MAPEI, Keraflex Plus.

2.6 GROUT MATERIALS

A. Polymer Ready-to-Use Specialty Grout: Grout joints from 1/16 inch to 1/2 inch (1.5 mm to 12 mm).

1. Product: MAPEI, MAPEI Flexcolor CQ.

2. Provide product with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D.

2.7 MISCELLANEOUS MATERIALS

A. 100%-Silicone Sealant: Heavy-traffic expansion and movement joints, horizontal and vertical complying with ASTM standards; ASTM: Meets C920, Type S, Grade NS, Class 25, Use T1, T2, NT, I, M, G, A and O, and conforms to C794 adhesion properties, (#23 Clear color meets ASTM C920, Type S, Grade NS, Class 50, Use NT).

1. Product: MAPEI, Mapesil T.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for conditions affecting performance of the work. Refer to ANSI A108.01, ANSI A108.02 and if applicable ANSI A108.19.

B. Do not proceed with tilework until surfaces and conditions comply with requirements indicated in reference tile installation standard and manufacturer's printed instructions.

C. When underlayment, patching, leveling and rendering materials are needed, they must be from the supplier of the setting materials. For improved warranty and single-source responsibility.

D. When using tiles with all edges shorter than 15 inches (38 cm) in length, maximum allowable variation in the substrate – 1/4-inch (6 mm) in 10 feet (3.05 m) from the required plane, with no more than 1/16 inch (1.5 mm) variation in 12 inches (30 cm) when measured from the high points in the surface.

E. When using large-format tiles with at least one edge of 15 inches (38 cm) in length, the maximum allowable variation in the substrate is 1/8 inch in 10 feet (3 mm in 3.05 m) from the required plane, and 1/16-inch variation in 24 inches (1.5 mm in 61 cm) when measured from the high points in the surface.

F. When using stone tile, the maximum allowable variation in the substrate is 1/8 inch in 10 feet (3 mm in 3.05 m) from the required plane.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with trowel able leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

3.3 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
   c. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush. Utilize Planitop 330 Fast, a quick-setting, polymer-modified, fiber-reinforced cementitious rendering, patching and leveling mortar for interior walls and floors. 3.2 Preparation A.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: As indicated on drawings.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Edge Strips: Install at locations indicated.

K. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

L. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

M. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. TCNA F113 or F115: Thinset mortar.
   a. Thinset Mortar: Improved modified dry-set mortar.
   b. Grout: Polymer Ready-to-Use Specialty Grout.
2. TCNA F125-Full, except where partial coverage is indicated: Thinset mortar on crack isolation membrane.
   a. Thinset Mortar: Improved modified dry-set mortar.
   b. Grout: Polymer Ready-to-Use Specialty Grout.

B. Interior Wall Installations:

1. TCNA W245 or TCNA W248: Thinset mortar on glass-mat, water-resistant gypsum backer board.
   a. Thinset Mortar: Improved modified dry-set mortar.
   b. Grout: Polymer Ready-to-Use Specialty Grout.

END OF SECTION 093013

SECTION 097050 – DECORATIVE BROADCAST EPOXY FLOOR

PART 1 - GENERAL

1.1 DELIVERY AND STORAGE

A. Material shall be delivered to project site in manufacturer's original unopened containers.

B. Materials shall be stored indoors, protected from damage, moisture, direct sunlight and temperatures below 40 degrees F. or above 90 degrees F.

1.2 ENVIRONMENTAL CONDITIONS

A. Surface and surrounding air temperatures must exceed 55 degrees F. but must be less than 90 degrees F., with materials at not less than 70 degrees F. during application.

1.3 QUALIFICATIONS OF APPLICATOR

A. Installation shall be performed by an applicator having satisfactory experience in the application of these or similar materials or with on-site consultation by a qualified field service representative of the manufacturer.

1.4 SUBMITTALS

A. Prior to commencing work, submit to owner, manufacturer's technical information and installation details describing materials to be used.

B. Owner, contractor, and manufacturer shall review and mutually agree upon color, grade, and final texture of coating system before starting installation. The acceptance of a sample will constitute the job standard by which installation will proceed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design:

1. Tnemec Company, Incorporated, 6800 Corporate Drive, Kansas City, Missouri 64120-1372. Local Representative Coating Solutions LLC 636-938-9292. Website www.tnemec.com

B. Acceptable Manufacturers

1. Dex-O-Tex

a. Style: Décor-Flor Broadcast

2. Dur-A-Flex
a. Style: Dur-A-Quartz System

2.2 MATERIALS: BASIS-OF-DESIGN

A. Base Coat: Series 222 Deco-Tread consisting of a two-component modified polyamine cured epoxy liquid and a colored quartz broadcast aggregate applied by double broadcast to provide a minimum 1/8"thickness.

B. Coving: Series 222 Deco-Tread, a two-component, modified polyamine cured epoxy liquid, blended as a mortar with decorative aggregate applied to form a cant or rolled radius cove.

C. Intermediate (grout coat): Series 284 two-component, polyamine cured epoxy finish. Thickness and number of coats will vary depending on desired finish.

D. Finish: Series 248 Everthane, a three-component aliphatic moisture cured urethane.

PART 3 - EXECUTION

3.1 PREPARATION

A. Allow new concrete to cure for 28 days at 75 degrees F. Verify concrete dryness and prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Moisture vapor transmission should not exceed three lbs per 1000 sq.ft. in a 24 hour period (reference ASTM F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.") Relative Humidity should not exceed 80%. (Reference ASTM F2170 “Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes.”) Note for moisture content exceeding three lbs or humidity above 80% , Series 241 may be substituted for the base coat. Refer to Series 241 product data sheet for more information.

B. Mechanically abrade all concrete and tile by means of self-contained, blasting equipment or equal, to remove all laitance and surface contaminants and provide a minimum profile similar to 60-80 grit sandpaper. (Reference ASTM D 4259, ICRI CSP 4-7)

C. After mechanically abrading, verify that all surfaces are clean, dry and free of any contaminants, which could adversely affect the adhesion of the flooring system.

3.2 INSTALLATION

A. Base Coat: The material shall be mixed, applied and cured in strict accordance with the manufacturer’s printed instructions. Apply by double broadcast to a minimum of 1/8" thickness.

B. Coving: 4” rolled radius cove bases shall be installed in accordance with the written instructions and as indicated on the Standard Flooring Details.

C. Intermediate (grout coat): The 100% solids, epoxy glaze coat shall be mechanically mixed in accordance with manufacturer's printed instructions and applied at a thickness within the manufactures recommendations. Thickness and number of coats will vary depending on desired finish. It should be topcoated after 12 hours, and within 24 hours.

D. Finish: The finish shall be mechanically mixed and applied in accordance with manufacturer's printed instructions and applied uniformly at a film thickness of 2 to 3 dry mils.

E. Joints: Active expansion joints shall be sawed through the floor topping system and filled with an appropriate flexible sealant.

3.3 JOB STANDARD

A. Prior to commencing the installation, the contractor shall install with the owner's approval, a mutually agreed upon test sample to show final color and appearance of the system. This test area shall serve as a job standard for the final installation.

3.4 CLEANUP

A. Remove waste materials, rubbish, and debris and dispose of them at the owner's direction. Leave work areas in a clean condition.

3.5 PROTECTION

A. Protect the completed work from water, airborne particles or other surface contaminants until cured for a minimum of 24 hours after application.

B. Protect from traffic, physical abuse, immersion and chemical exposure until the complete system has thoroughly cured for 24 hours at 75 degrees F. For different temperatures, consult the manufacturer's representative about curing times.

END OF SECTION 097050

SECTION 097511 – SOLID SURFACE WALL CLADDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following horizontal and trim solid surface product types:

1. Shower wall panels.
2. Bench cladding

1.2 DEFINITION

A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.3 SUBMITTALS

A. A. Product data:

1. For each type of product indicated.
2. Product data for the following:

B. Shop drawings:

1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
    a. Show full-size details, edge details, thermoforming requirements, attachments, etc.
    b. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.

C. Samples:

1. For each type of product indicated.
    a. Submit minimum 6-inch by 6-inch sample in specified gloss.
    b. Cut sample and seam together for representation of inconspicuous seam.
    c. Indicate full range of color and pattern variation.

D. Product data:

1. Indicate product description, fabrication information and compliance with specified performance requirements.

E. Sustainable submittals:

1. Manufacturer's product data for installation adhesives, including printed statement of VOC content and material safety data sheets.

F. Maintenance data:

1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions.

a. Maintenance kit for finishes shall be submitted.

2. Include in project closeout documents.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

B. Fabricator/installer qualifications:

1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

C. Applicable standards:

1. Standards of the following, as referenced herein:

a. American National Standards Institute (ANSI)
b. American Society for Testing and Materials (ASTM)
c. National Electrical Manufacturers Association (NEMA)

2. Fire test response characteristics:

a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:

1) Flame Spread Index: 25 or less.
2) Smoke Developed Index: 450 or less.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation.

B. Store components indoors prior to installation.

C. Handle materials to prevent damage to finished surfaces.

1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.6 WARRANTY

A. Provide manufacturer's warranty against defects in materials.

1. Warranty shall provide material and labor to repair or replace defective materials.
2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Subject to compliance with requirements, provide products by one of the following:
a. Avonite.
b. Corian® solid surfaces from the DuPont Company (basis of design).
c. The Onyx Collection.
d. Swan.

2.2 MATERIALS

A. Solid polymer components

1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
2. Superficial damage to a depth of 0.010 inch (25 mm) shall be repairable by sanding and/or polishing.
3. Thickness: As indicated on drawings.
4. Edge: 1/16-inch radius,
5. Finish: Smooth, gloss.
6. Color: As indicated and selected from manufacturer's standard line.

B. Performance Requirements:

1. Tensile Strength: 6,000 psi; ASTM D 638
2. Tensile Modulus: 1.5 x 10-6 psi; ASTM D 638
3. Tensile Elongation: 0.4% min.; ASTM D 638
4. Flexural Strength: 10,000 psi; ASTM D 790
5. Flexural Modulus: 1.2 x 10-6 psi; ASTM D 790
6. Hardness: >85 Rockwell "M" Scale; ASTM D 785
7. Thermal Expansion: 3.02 x 10-5 in./in./°C; ASTM D 696
8. Gloss: (60° Gardner) 5–75 (matte—highly polished); ANSI Z124

9. Light Resistance: (Xenon Arc) No effect; NEMA LD 3-2000 Method 3.3
10. Wear and Cleanability: ANSI Z124.3 &Z124.6
11. Stain Resistance: ANSI Z124.3 & Z124.6
12. Fungus and Bacteria Resistance: Does not support microbial growth; ASTM G21&G22
13. Water Absorption: 0.8%; ASTM D 570
14. Flammability: ASTM E 84,(Class I and Class A) NFPA 255 & UL 723
    a. Flame Spread Index <25
    b. Smoke Developed Index <25

2.3 ACCESSORIES

A. Joint adhesive:

B. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.

C. Panel adhesive:

1. Manufacturer's standard neoprene-based panel adhesive complying with ANSI A136.1-1967, UL listed.

D. Sealant:

1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.

E. Provide matching shelf soap dish cast from solid surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances, and other conditions affecting performance of work.

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

3.2 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/8 inch in 96 inches (3 mm in 2400 mm), 1/4 inch (6 mm) maximum.

3.3 INSTALLATION

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

1. Provide product in the largest pieces available.
2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
    a. Exposed joints/seams shall not be allowed.
3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
4. Cut and finish component edges with clean, sharp returns.
5. Rout radii and contours to template.
6. Carefully dress joints smooth, remove surface scratches and clean entire surface.

3.4 INSTALLATION OF JOINT SEALANT

A. Prepare joints and apply sealants to comply with applicable requirements in Section 079200 "Joint Sealants." Remove temporary shims before applying sealants.

3.5 ADJUSTING AND CLEANING

A. Keep components clean during installation.

B. Remove adhesives, sealants and other stains.

END OF SECTION

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:
   1. Section 099600 "High-Performance Coatings".

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

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

   1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

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

1. Submit Samples on rigid backing, 12 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.
5. Label each sample with date of final coat; samples will not be reviewed until they have dried at least four days.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

E. Shop Drawings: Dimensioned drawings including field conditions/obstructions for all stenciled graphics.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 1 gal. (3.8 L) of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups 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.

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 mockups of additional colors selected by Architect at no added cost to Owner.

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. Subject to compliance with requirements, approved mockups 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 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.

1.8 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 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. Pratt & Lambert.
3. Sherwin-Williams Company (The).
4. Or Approved Equal

B. Products: Provide products which comply with requirements listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, 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.

B. VOC Content: For field applications inside the building, wall paints shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Interior Flat Latex Wall Paint: 50 g/L.
2. Interior Nonflat Latex Wall Paint: 150 g/L.

C. VOC Emissions: For field applications inside the building, wall paints shall contain no more than half of the chronic REL of VOCs when tested according to the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

D. Colors: As selected by Architect from manufacturer's full range.

1. Ten percent of surface area will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints 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. Gypsum Board: 12 percent.
2. 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 suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.

b. Uninsulated metal piping, except steam 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.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. **Interior Drywall - Pool Area Walls** - Waterbased Catalyzed Epoxy Finish Coat

1. Prime Coat: B28W2600 ProMar 200 Zero VOC Interior Latex Primer
2. Two Finish Coats: B73W361 Pro Industrial Waterbased Catalyzed Epoxy - Eg-Shel or B73W311 Pro Industrial Waterbased Catalyzed Epoxy – Gloss

B. **Interior Drywall - Locker Room Walls** - PreCatalyzed Waterbased Epoxy Finish Coat

1. Prime Coat: B28W2600 ProMar 200 Zero VOC Interior Latex Primer

2. Two Finish Coats: K45W1151 Pro Industrial PreCatalyzed Waterbased Epoxy - Eg-Shel or K46W1151 Pro Industrial PreCatalyzed Waterbased Epoxy - Semi-Gloss

C. **Pool Areas - Hollow Metal Doors and Frames** - Waterbased Catalyzed Epoxy Finish Coat

1. Touch Up Prime Coat (bare or rusting ferrous metal areas only): B50WZ4 Kem Bond HS High Solids Alkyd Universal Metal Primer
2. Touch Up Prime Coat (bare galvanized metal areas only): B66W1310 Pro Industrial Pro-Cryl Universal Primer
3. Two Finish Coats: B73W361 Pro Industrial Waterbased Catalyzed Epoxy - Eg-Shel or B73W311 Pro Industrial Waterbased Catalyzed Epoxy – Gloss

D. **Locker Rooms - Hollow Metal Doors and Frames** - PreCatalyzed Waterbased Epoxy Finish Coat

1. Touch Up Prime Coat (bare or rusting ferrous metal areas only): B50WZ4 Kem Bond HS High Solids Alkyd Universal Metal Primer
2. Touch Up Prime Coat (bare galvanized metal areas only): B66W1310 Pro Industrial Pro-Cryl Universal Primer
3. Two Finish Coats: K45W1151 Pro Industrial PreCatalyzed Waterbased Epoxy - Eg-Shel or K46W1151 Pro Industrial PreCatalyzed Waterbased Epoxy - Semi-Gloss

Notes:

1. Wash/clean all surfaces to be painted to remove all dirt, grease, chalk, loose paint and surface contaminates.
2. Where a sheen is present on the existing coating, sand the existing paint finish to create a surface profile so the new coating can obtain proper adhesion.
3. If the surfaces to be painted are heavily contaminated with grease or oil, clean the highly contaminated areas with Great Lakes Laboratories Extra Muscle Prepaint Cleaner.
4. On ferrous metal surfaces remove all loose existing paint and corrosion by using SSPC–SP2 Hand Tool Cleaning and SSPC-SP3 Power Tool Cleaning.
5. Follow all instructions on the Product Data Sheet and Product Label.
6. Mock up samples should be applied before the start of the project to insure the acceptable and successful installation technique. Successful mock up samples will also help insure the compatibility of the new coatings with the substrate. Acceptable mock up samples can then be approved by the owner/design professional before the start of the project.
7. All epoxy coatings can yellow slightly as they age. If a pure white/near white color is selected, B65W721 Waterbased Acrolon 100 Polyurethane can be used as a finish coat. Polyurethane Finish Coats will maintain their white color.
8. Please contact a local Sherwin-Williams Commercial Representative to assist with the application of the mock up samples if needed.

END OF SECTION 099123

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:
1. Section 061053 "Miscellaneous Rough Carpentry" for blocking.
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Solid-plastic toilet compartments:

B. Shop Drawings: For solid-plastic toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.

C. Samples: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

D. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Product Certificates: For each type of toilet compartment by manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Regulatory Requirements: Comply with applicable provisions in the U.S. Department of Justice "2010 ADA Standards for Accessible Design" and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

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

1. ASI Accurate Partitions.
2. ASI Global Partitions.
3. Hadrian Inc.; Zurn Industries, LLC.
4. Knickerbocker Partition Corporation.
5. Scranton Products.

B. Toilet-Enclosure Style: Floor Anchored / Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door Width: 24 inches (609 mm) and 36 inches (914 mm).

E. Door Height Above Floor: 14 inches (305 mm).

F. Door Panel Height: 55 inches (1473 mm).

G. Pilaster Height: As indicated on Drawings.

H. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, and integral no-sightline privacy system including profile on strike and hinge side that overlaps adjacent pilaster with homogenous color and pattern throughout thickness of material.
1. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip fastened to exposed bottom edges of solid-HDPE components to hinder malicious combustion.
2. Finish Texture: Pebble Grained.
3. Color and Pattern: One color and pattern as selected by Architect from manufacturer's full range.

I. Pilaster Shoes: Stainless steel sheet, not less than 0.031 inch (0.79 mm) nominal thickness and 3 inches (76 mm) high, with No. 4 satin finish. Shoe bottom enclosed and integral to compartment structure. Secure to floor with manufacturer's recommended concrete anchors.

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

K. Overhead Cross Bracing for Ceiling-Hung Units: As recommended by manufacturer and fabricated from solid polymer.

2.3 HARDWARE AND ACCESSORIES

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

1. Material: Stainless steel.
2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position, 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 inswinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at outswinging doors.
6. Door Pull: Manufacturer's standard unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M).

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

E. Zamac: ASTM B86, commercial zinc-alloy die castings.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. 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. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, inswinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, outswinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
   1. Confirm location and adequacy of blocking and supports required for installation.

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

3.2 INSTALLATION OF HDPE TOILET COMPARTMENTS

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch (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. 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 pilaster shoes 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. 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.

D. 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.

E. 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 in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION 102113.19

SECTION 105129 – PHENOLIC LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic Lockers.

1.2 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 each type of locker.

B. Shop Drawings: For plastic-laminate-clad wood lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in lockers.
5. Show locker fillers, trim, base, sloping tops, and accessories.
6. Show locker identification system and numbering sequence.

C. Samples for Verification: For the following products:

1. For each type of locker include no less than three of each standard phenolic, hardware and/or accessories involving material and color selection.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until painting and similar operations that could damage lockers have been completed in installation areas. If lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are the same as those in final installation location, and comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install lockers 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 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where lockers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support lockers by field measurements before being enclosed and indicate measurements on Shop Drawings.

C. Established Dimensions: Where lockers are indicated to fit to other construction, establish dimensions for areas where lockers are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of concealed wood support bases.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that lockers can be supported and installed as indicated.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of lockers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of locks or hardware.
c. Deterioration of finishes, and other materials beyond normal use.

2. Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 PHENOLIC LOCKERS

A. Material shall be solid phenolic, a cured solid material produced by resin-injecting sheets of Kraft paper, with high-pressure melamine matte finish surface made as an integral part of the core material. Surfaces and edges shall be non-porous and shall not support fungus or bacteria. Provide material which has been selected for uniform color, surface flatness and smoothness. Fabricate lockers square, rigid and without warp.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hallowell VERSAMAX or comparable product by one of the following:

    a. List Industries Inc.
    b. Scranton Products.

2.3 MATERIALS

A. Material Thicknesses:

1. Doors, slope tops, end panels and toe kick plates – Minimum 0.50 inch (13 mm) Finished Thickness.
2. Locker Boxes:
3. Tops, bottoms, sides and shelves – Minimum 0.375 inch (10 mm) Finished Thickness.
4. Locker backs – Minimum 0.25 inch (6.35 mm) Finished Thickness.
5. Locker Doors: Locker door shall be the full width of the locker box and shall be frameless, allowing access to the entire width of the locker.
6. Locker Body: Locker body shall be white in color and will be mechanically fastened with stainless steel fastener. Hinges will be attached to the locker box with stainless steel theft proof torx-head screws. Lockers will have a 6 mm ventilation gap between locker door and box. Lockers shall arrive at construction site fully assembled.
7. Color: To be selected from manufacturer’s full range of colors.

2.4 LOCKER MODELS

A. Single tier, Model A: (60 inch H x 18 inch W x 20 inch D), two (2) coat hooks, one (1) ceiling coat hook, one (1) hat shelf and one (1) shoe shelf.

2.5 HARDWARE

A. Handle/Latch: Hasp shall be fabricated of 11 gauge type 304 stainless steel with a satin finish. All edges shall be polished and smooth. Hasp shall be attached to the locker body with two (2) stainless steel theft proof torx-head with pin, through bolts. Hasp shall extend through a slot in the face of the locker door. Handle shall be finger pull type. ADA compliant.

B. Hinges: Satin finish, 5-knuckle “hospital” type with beveled top and bottom knuckles. Knuckles of hinge shall be exposed to allow door to open 180 degrees. Hinges shall be made of 14 gauge type 304 stainless steel.

C. Coat Hooks: Coat hooks shall be fabricated of 12 gauge type 304 stainless steel with a satin finish. All edges shall be polished and smooth.

D. Locks: Standard lock for phenolic lockers. Padlock ready.

E. Number Plates: Aluminum with not less than 3/8 inch high etched numbers attached to door with theft proof fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that furring is attached to concrete and masonry walls that are to receive lockers.

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

3.2 PREPARATION

A. Condition lockers to average prevailing humidity conditions in installation areas before installation.

B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Install lockers level, plumb, and true; use concealed shims.

B. Connect groups of lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.

C. Install lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Installation Tolerance: No more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line. Shim as required with concealed shims.

D. Locker Anchorage:

1. Fasten lockers approximately 48 inches o.c. unless otherwise recommended by manufacturer.

E. Install end panels, filler panels, tops and bases as indicated on the approved shop drawings.

F. Attach sloping-top units to lockers, with end panels covering exposed ends.

3.4 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding.

3.5 PROTECTION

A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up, repair or replace damaged products. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105123

SECTION 131100 - SWIMMING POOLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT and applicable parts of DIVISION 1 - GENERAL REQUIREMENTS, as listed in the Table of Contents, be included in, and made a part of this Section.

1.02 SUMMARY OF WORK *(for general guidance-not inclusive*)

A. Introduction

1. Provide labor, materials, equipment, and services necessary to renovate the pool. This work must include the structure(s) and installation of pool finishes as well as products listed in Part 2 of Section 131100.

B. Work included in this section:

1. Under this section the Swimming Pool Contractor will provide but is not necessarily limited to the following:

a. Provide equipment and services required for erection and delivery onto the premises the equipment or apparatus provided. Remove equipment from premises when no longer required.

b. Provide and maintain proper shoring and bracing for existing utilities, sewers and building foundations where required for related excavations per Section 312000 – Earth Moving.

c. Provide electrical conduit, wiring, junction boxes etc. to low voltage pool equipment within pool filter/chemical rooms per Division 26 - Electrical. (Low voltage is considered less than 110 V.)

d. Coordinate for required bonding and grounding of the pool shell, fittings, and equipment.

e. Provide necessary piping and valving as shown on the drawings and specified herein.

f. Provide individually sized housekeeping pads for each pool pump. Provide housekeeping pads for pool equipment as required in the drawings.

g. Provide the main drain hydrostatic relief system as shown on the drawings.

Replace the cast in place or pneumatically applied concrete pool shell as described in these specifications and detailed on the drawings, including reinforcement steel, inserts, fittings, fiberglass main drain sumps and embedded items (piping, anchors, etc.) for the pool. Reference Division 3 - Concrete and Structural. Before commencing the placement of concrete, verify electrical bonding of the pool and spa embedded items and reinforcing steel. Also, coordinate and arrange required electrical, plumbing and or building inspections.

h. Provide tile replacement in the pool structures. Reference Section 131103 - Swimming Pool Tile - including the tolerance requirements for the concrete substrate.

i. Provide fully assembled cleaning and maintenance equipment for the `pool as specified herein.

j. Provide for the storage of pool related equipment, materials, and systems. Items are the responsibility of the CONTRACTOR until accepted by owner.

k. Obtain final acceptance by jurisdictional health department(s).

l. Start, test, calibrate and adjust mechanical equipment, electrical equipment, recirculation, chemical, and other supplied systems including deck, loose, maintenance, and safety equipment. Instruct the Owner's representative in the systems operation and maintenance as described herein.

m. Provide a one-year license and basic startup training for aquatic facility management application.

C. Related work specified in other sections:

1. Section 131103 – Swimming Pool Tile

2. Section 131105 – Selective Demolition

3. The following work related to the swimming pools must be completed by other trades.

a. Provide, erect, and maintain necessary barricades, signs, lights, and flares for pool construction to protect workers and the public.

b. Provide and maintain proper shoring and bracing for existing utilities, sewers and building foundations where required for swimming pool related excavations per Section 312000 – Earth Moving.

c. Construct pump pit and backwash pit including reinforcement, inserts, wall sleeves, anchors, access hatches, and fittings. Reference Division 3 - Concrete.

d. Prior to concrete pours, verify electrical bonding of the pool embedded items. Coordinate and arrange required electrical, plumbing and or building inspections that must be performed on embedded items. Reference Division 26 - Electrical.

e. Provide sanitary sewer and storm drain connections. Reference Division 22 - Plumbing.

f. Provide deck mounted anchors, sockets, and inserts for the `pool and coordinate construction locations for each.

g. Provide deck finish beyond perimeter tile band.

h. Provide rules and regulations signage as required by code. Reference Division 1 - General Requirements.

i. Provide chlorine resistant caulking (sealant) and backer rod on pool decks.

D. Related work specified in Plumbing section. Reference Division 22 - Plumbing. Work that must completed by others.

1. Provide area drains on pool deck.

2. Provide water service to hose bibbs, flush hydrant boxes and auto-fill bypass to air gap above fill funnel(s). Provide the slow closing solenoid valve(s) in the bypass auto-fill piping.

3. Provide water meter on the fresh water supply line upstream of the manual fill valve and the slow closing solenoid valve.

E. Related work specified in Mechanical section. Reference Division 23 – Mechanical/HVAC. Work that must completed by others.

1. Provide the heating system for the pool. Work to include piping from the pool heating loop tees, heaters, booster pumps, controls, gauges, thermostats, control valves and wiring required to draw water from the recirculation line, heat the water and return it back to the recirculation line and interlock with pool recirculation pumps.

F. Related work specified in Electrical sections. Reference Division 26 – Electrical. Work that must completed by others.

1. Provide power to the exhaust fans for the chemical rooms.

2. Provide motor starters, auxiliary contacts, magnetic relays, and other electrical control devices necessary for the complete operation of the pool systems. Provide power to Variable Frequency Drive pool pump starters and power from VFD to the pool pump motor.

3. Ground and bond pool structures, fittings, and equipment in accordance with Article 680 of the N.E.C. Test and verify that the system electrical ground is true and solid. Provide certification to this effort.

4. Obtain permits, inspections, and approvals of wiring including grounding and bonding of metal components associated with the pool in accordance with Local, State and National Electrical Codes.

5. Confirm electrical conduits that penetrate the pool shell are watertight and installed per N.E.C. Article 680.

1.03 QUALITY ASSURANCE

A. Swimming Pool Installer will be identified by the bidder and will be reviewed and approved prior to accepting the bid

1.04 REGULATORY AGENCY REQUIREMENTS AND ENGINEERING SERVICES

A. The system must comply with necessary pre-construction approvals obtained by the Owner and Owner’s Consultants from local regulatory agencies governing the design and construction of public swimming pools.

B. Give necessary notices, obtain permits, and pay government fees, and other costs in connection with his work, including the filing of necessary as-built drawings, prepare documents and obtain necessary approvals of governmental departments having

jurisdiction over their work. Obtain required certificates of inspection for his work and deliver same to the Owner and Owner's Consultants before requesting acceptance and final payment for the work.

C. Include in the work, without extra cost to the Owner, labor, materials, services, apparatus, or drawings in order to comply with applicable laws, ordinances, rules, and regulations, whether or not shown on drawings and/or specified.

1.05 COORDINATION AND CLARIFICATION

A. Coordinate with other contractors or subcontractors work relating to this section.

B. Must establish with other contractors or subcontractors, having related work in this section, that work necessary to complete the `pool as shown on the drawings and in the specifications is included in the base bid and alternates to the Owner.

C. If in doubt regarding the responsibility for work covered in this section and/or discovery of errors or omissions in the bidding documents, notify the Architect through channels established by the specifications and request a clarification ten (10) days prior to the bid date.

1.06 ALTERNATES

A. Review the description of the alternates in Division 1 and on the drawings for possible effect upon work in this section. Alternates related to the work in this section are described in this division and on the bid proposal form.

1.07 CONTRACTOR'S ALTERNATE PROPOSAL

A. If there is a deviation from the basis of design equipment, confirm that engineering criteria are appropriate for the substituted equipment.

B. Substitutions of specified construction methods and equipment must include a complete submittal as required by these specifications and drawings of appropriate scale incorporating required changes. Provide a list of at least ten (10) satisfactory installations comparable to this project that have been manufactured and installed under the manufacturer's current legal name. Submit a list of such projects with the name, address and current telephone number of the Owner's Operator and Architect of Record to the Architect on the bid date.

C. Changes or modifications to the Contract Documents that are not authorized by the architect are the sole responsibility of the Contractor.

1.08 SUBMITTALS

A. Submittals must be made in accordance with the requirements of Division 1 - General Requirements and in strict compliance with the following procedures and guidelines.

B. One (1) set of shop drawings and engineering data must be tabbed, indexed, and referenced to the specifications, compiled into an electronic submittal, and submitted in two stages. The first stage must include items for the pool shell repair, reference concrete

specifications. The second stage must be for remaining items. Each section of items mu t be prefaced by a cover sheet listing the items submitted within the section. Electronic submittals must be organized, numbered, and submitted in the same format and order as the project specifications. Only complete sets will be reviewed.

1. Engineering data covering systems, equipment, structures, and fabricated materials, which will become a permanent part of the work under this contract, must be submitted for review. This data must include drawings and descriptive information in sufficient detail and scale to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorage and supports required; performance characteristics; fabrication and dimensions needed for installation and correlation with other materials and equipment. A certification, in writing, must be provided indicating that equipment will fit in the space allotted and as shown on the drawings.

2. Submittals regardless of origin must be stamped with the approval of the CONTRACTOR and identified with the name and number of this contract, CONTRACTOR'S name, and references to applicable specification paragraphs and contract drawings. Each submittal must indicate the intended use of the item in the work. When catalog pages are submitted, applicable items must be clearly identified. The current revision, issue number, and date must be indicated on drawings and other descriptive data.

3. The submittals will not be accepted from anyone but the CONTRACTOR. Submittals must be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

4. The CONTRACTOR'S stamp of approval is a representation that the CONTRACTOR accepts full responsibility for determining and verifying quantities, dimensions, field construction criteria, materials, catalog numbers and similar data, and that he has reviewed or coordinated each submittal with the requirements of the work and the contract documents.

5. Each submittal must include a statement prepared by the originator of the drawings and data, certifying compliance with the contract documents except for deviations, which are specifically identified.

6. Deviations from the contract documents must be identified on each submittal and must be tabulated in the CONTRACTOR'S letter of transmittal. Such submittals must, as pertinent to the deviation, indicate essential details of changes by the CONTRACTOR (including modifications to other facilities that may be a result of the deviation) and required piping and wiring diagrams.

7. The CONTRACTOR must accept full responsibility for the completeness of each submission, and, in the case of a resubmission, must verify that exceptions previously noted have been considered. In the event that more than one resubmission is required because of failure of CONTRACTOR to respond to exceptions and rejections previously noted, CONTRACTOR must make further resubmissions in person at the consultant's office.

8. The need for more than one resubmission, or a delay in obtaining review of submittals, will not entitle the CONTRACTOR to an extension of the contract time unless delay of the work is directly caused by a change in the work authorized by a change order.

9. Review of drawings and data submitted by CONTRACTOR will cover only general conformity to the drawings and specifications, external connections and dimensions that affect the layout. Review does not indicate a thorough review of dimensions, quantities, and details of the material, equipment, device, or item shown. Review of submittals does not relieve CONTRACTOR from responsibility for errors, omissions, or deviations, or responsibility for compliance with the contract documents.

10. When the drawings and data are returned marked REJECTED, REVISE AND RESUBMIT or SUBMIT SPECIFIED ITEM, the corrections must be made as noted thereon and as instructed and six corrected copies (or one copy and one corrected reproducible copy) resubmitted.

11. Resubmittals must bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal. Resubmittals must be indexed, tabbed, referenced to the specifications, and bound in a three-ring binder and submitted at one time.

12. When corrected copies are resubmitted, the CONTRACTOR must, in writing, direct specific attention to revisions and must list separately revisions made other than those called for on previous submissions.

13. When the drawings and data are returned marked NO EXCEPTIONS TAKEN or MAKE CORRECTIONS NOTED, no additional copies must be provided unless specifically requested to do so for record.

C. Include complete product data indexed, tabbed, and referenced to specifications with 8 ½" x 11" cover sheet covering:

1. Paragraph 2.01 - Overflow System
2. Paragraph 2.02 - Pumping Equipment
3. Paragraph 2.03 - Filtration Equipment
4. Paragraph 2.04 - Recirculation Fittings
5. Paragraph 2.05 - Piping Systems
6. Paragraph 2.06 - Chemical Treatment Systems
7. Paragraph 2.07 - Chemistry Monitoring and Control Systems
8. Paragraph 2.08 - Flow Meters
9. Paragraph 2.09 - Water Level Controllers
10. Paragraph 2.10 - Deck Equipment
11. Paragraph 2.11 - Loose Equipment
12. Paragraph 2.12 - Maintenance Equipment
13. Paragraph 2.13 - Safety Equipment
14. Paragraph 2.14 - Thermometers
15. Paragraph 2.15 – Swimming Pool Finishes
16. Paragraph 2.16 – Sealants
17. Paragraph 2.17 - Pool Concrete Coping

18. Paragraph 2.18 - Swimming Pool Surface Padding

D. Include engineering/construction drawings for the pool structure.

1. Reference Division 3 - Concrete.

E. Include engineering construction drawings for pool piping.

F. Reference Section 13154/131103 – Swimming Pool Tile

G. Reference Section 13159/131105 – Selective Demolition

1.09 OPERATION AND MAINTENANCE MANUALS AND CLOSE-OUT SUBMITTALS

A. Detailed operation and maintenance information must be supplied for equipment requiring maintenance or other attention. The equipment supplier and/or CONTRACTOR must prepare an operation and maintenance manual for equipment. Parts lists and operating, and maintenance instructions must be provided.

B. Each operation and maintenance manual must include the following:

1. Equipment function and calibration, normal operating characteristics, and limiting conditions.

2. Assembly, installation, alignment, adjustment and checking instructions.

3. Operating instructions for startup, routine and normal operation, regulation, and control, shut down and emergency conditions.

4. One (1) copy of instructional videos.

5. Operating cycles must be specifically described in outline format and in referenced detail. A wall-mounted color-coded piping flow diagram must be provided in the pool equipment room. The diagram must be engraved on laminated plastic with color-coded piping to match color of coding on piping, and including valves identified with number on tags. The minimum size is 11-inch x 17 inch.

6. Include manufacturer recommended maintenance schedule, parts lists, piping diagram (to agree with wall mounted diagram) and trouble-shooting information for pool mechanical equipment.

7. Using reference to keyed valves and wall diagram, include specific written instructions for procedures that must be followed for the following:

a. Emptying and refilling the `pool including de-watering during the period that the `pool will be empty.

b. Water level control adjustment and chemical control operation.

c. Filter operation and backwashing; and

d. Super chlorination.

8. Lubrication and maintenance instructions.

9. Guide to “trouble-shooting”.

10. Parts list and predicted life of parts subject to wear.

11. Outline, cross section, and assembly drawings; engineering data and wiring diagrams.

12. Test data and performance curves, where applicable.

13. Specific written instructions for procedure for emptying and refilling the `pool including de-watering during the period that the pool will be empty. Provide a yellow warning sign 8-1/2 in. x 11 in., that must be mounted in the filter room, that reads:

WARNING
Prior to emptying Pool
Consult O & M Manuals for Procedures

Add another sign that reads:

Keep Caps, Plugs and Tops Tight Fitting to Prevent Escape of Fumes.

14. One set of applicable submittals must be included in each manual.

C. The operation and maintenance manuals must be in addition to instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by the CONTRACTOR.

D. Manuals and other data must be printed on heavy, first quality paper, 8-1/2 x 11-inch size with standard 3-hole punching and inserted in plastic covers. Drawings and diagrams must be reduced to 8-1/2 x 11 inches or 11 x 17 inches. Where reduction is not practical, larger drawings must be folded separately and placed in envelopes that are bound into the manuals. Each envelope must bear suitable identification on the outside.

E. Six (6) bound volumes of each manual must be submitted. Parts lists and information must be assembled in substantial manuals and permanent, three-ring or three-post binders. Material must be assembled and bound in the same order as specified, and each volume must have a table of contents and suitable index tabs.

F. Material must be marked with project identification. Non-applicable information must be marked out or deleted.

G. Shipment of equipment will not be considered complete until required manuals and data have been received.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original, unopened containers and crates with labels intact and legible.

B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.

C. Handle materials in a manner to prevent damage.

D. Store materials on clean raised platforms with weather protective coverings. Provide continuous protection of materials against damage or deterioration.

E. Remove damaged materials from site.

1.11 WARRANTIES

A. The CONTRACTOR warrants to the Owner and Architect that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements, including substitutions not properly approved and authorized will be considered defective. The CONTRACTOR'S warranty will exclude remedies for damage or defect caused by abuse, improper or insufficient maintenance, improper operations, modifications not executed by the CONTRACTOR or improper wear and tear under normal use. If required by the Architect, provide satisfactory evidence as to the kind and quality of materials and equipment.

B. The CONTRACTOR must agree to repair or replace defective or non-complying work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.

C. Warranties must be for a period of one year from the date of substantial completion unless otherwise noted. Submit warranties covering, but not limited to the following:

1. Defects in material or workmanship of the pool structure causing a loss of water for a period of three (3) years.
2. Defects in material, manufacture and installation of the filtration, backwash, chlorination, pH adjustments and cleaning systems, including controls for a period of one (1) year.
3. Defects in material, manufacture or installation of the recirculating overflow system trench for a period of one (1) year.
4. Defects in material, workmanship, and installation of the pool pumps for a period of one (1) year.
5. Manufacturer's minimum eighteen (18) month warranty against defective materials, components, and workmanship in the variable frequency drive system.
6. Manufacturer's minimum fifteen (15) year warranty on the filter tank and lining against defective materials or workmanship of the tank and components. (Additional warranty time may be purchased from the manufacturer.) Prorated warranties are not acceptable.
7. Defects in material, workmanship, and installation of the pool piping system and recirculation fittings for a period of three (3) years.
8. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the sanitizing feed system.
9. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the pH buffer feed system.
10. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the ultraviolet sanitizing system (excluding the UV lamps, quartz, and seals). Medium pressure ultraviolet bulbs must be

warranted for a period of 8,000 hours. Intermittently operated lamps (≥ 1 on/off cycle per day) will be replaced free of charge should failure occur prior to 4,000 hours and replacement will be prorated between 4,000 and 8,000 hours.

11. Manufacturer's minimum five (5) year warranty against defective materials, components, and workmanship in the pool chemical controller. ORP, pH, flow and temperature sensors must be covered by a standard two (2) year warranty. Other sensors and flow cell components must be covered by a standard one (1) year warranty.

12. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the pool water level control system.

13. Defects in material, workmanship, and installation of loose, deck, maintenance, and safety equipment including deck anchors for a minimum period of one (1) year.

14. Defects in material, workmanship, and installation of the tile finish against cracking and delamination for a period of five (5) years.

15. Manufacturer's minimum fifteen (15) year systems warranty against defective materials, components and workmanship in the pool tile setting materials.

16. Defects in material, workmanship and installation of the pool coping against cracking and delamination for a period of one (1) year.

17. Manufacturer’s minimum three (3) year warranty against defective, materials, components, and workmanship in the pool safety pad system.

1.12 SYSTEM TRAINING

A. A qualified representative of the CONTRACTOR performing work under this section must put the equipment into operation and instruct the Owner's representatives in the operation of this equipment to the Owner's satisfaction immediately after project’s substantial completion.

B. The CONTRACTOR’S training representative must have completed the equipment/system’s manufacturer’s training requirements and be certified, by the manufacturer, to provide and teach system training.

C. The representative from the CONTRACTOR must be either a CPO (Certified Pool Operator) or have an AFO (Aquatic Facility Operator) certification.

D. Training periods to consist of 32 hours of on-site training and scheduled as follows:

1. 16 hours of initial training on the complete swimming pool system. The 16 hours of initial training must be comprised of at least 4 hours of training on water chemistry analysis and adjustment. The water chemistry training will include in depth review of the use of the Langlier index and its computation.

2. The initial 16 hours of training must include information on the care, operation, adjustment, and maintenance of items provided by the CONTRACTOR under the “Part 2 – Products” section of this specification.

3. 16 hours of training after the Owner's staff has had experience operating the system. This time may be requested after the pool has been placed in operation

within a period of one (1) year from the time the pool was accepted by the Owner. The additional training must contain at least 2 hours of review of water chemistry.

4. Provide a project specific video recording instruction manual in addition to the training sessions. The video instructions must be project specific and must include information on the care, operation, adjustment, and maintenance of items provided by the CONTRACTOR under the "Part 2 – Products" section of this specification. This video recording must be done separate from the Owner training.

5. The CONTRACTOR must include one (1) copy of video recording instructions in each Operations and Maintenance Manual.

1.13 POOL FILL WATER QUALITY

A. The Owner is to bear the cost of the water required for two (2) complete fillings of the pool (the initial water tightness test and the final filling). Removal of iron or copper (if in excess of .3 ppm) will be required for the final fill to avoid staining of the pool finish. Subsequent fillings or partial fillings (more than 25%) of the pool is by the CONTRACTOR, at its own expense.

B. Provide the necessary plant equipment so that the temperature of fill water will be within plus or minus 10 degrees of the ambient air and/or the pool structure at the time of filling. Extreme caution is urged if the temperature variance is greater than 10-degree F.

C. Provide the necessary chemicals and to adjust and balance the water chemistry in the pools to the following levels:

pH	7.4 - 7.6
Calcium Hardness	200 - 400 PPM
Total Alkalinity (Calcium Hypochlorite)	60 - 80 PPM
Total Alkalinity (Sodium Hypochlorite)	80 - 120 PPM
Langelier saturation index	-0.3 - +0.3
Total Dissolved Solids (TDS)	not to exceed 1,500 PPM

1.14 START-UP CHEMICALS

A. The CONTRACTOR must maintain the chemical balance of the pool water (including the cost of chemicals required) until the pool and mechanical system(s) are fully operational and accepted by the Architect and the Owner.

B. Provide the Owner with sufficient quantities of the necessary chemicals to maintain the pool operation after the owner begins using the pool.

1. Contractor is required to provide chemical quantities as shown on the drawings for the following chemicals:

a. Calcium Hypochlorite

b. Sodium Bisulfate

2. Contractor is required to provide chemical quantities as shown on the drawings for the following balancing chemicals:

a. Sodium Bicarbonate

b. Calcium Carbonate

c. Sodium Thiosulfate

C. Chemicals must be provided to the Owner must include those required by the chemical feed systems provided.

1.15 RECORD DRAWINGS

A. Provide a complete set of record drawings of the entire pool system(s) including sub-systems. Record drawings must be prepared in accordance with the requirements of General Conditions Article 5.4-H.d and must be a complete, stand-alone set. The CONTRACTOR is permitted to obtain original documents and copy them for this purpose only.

PART 2 - PRODUCTS

2.01 OVERFLOW SYSTEM

A. It is the intent of the specifications that the perimeter overflow system and surface cleaning be maintained under conditions of normal operation and that no water be discharged to waste except when cleaning the filters or emptying the pool.

B. Skimmer Overflow System

1. Provide skimming system consisting of units as shown on the drawings. Skimmers must be located to ensure maximum skimming action.

a. Basis of Design: Pool skimmers must be Sta-Rite model U-3 #08650-1403 white, Hayward model #SP1082-1 or Waterway model #810-0054.0618 Renegade Gunite skimmer.

2. The piping and other pertinent components of skimming equipment must be designed for a total capacity of the required filter flow of the recirculation system, and no skimmer can be designed for a flow-through rate of less than 30 gallons per minute or 5 gallons per minute per lineal inch of weir.

3. The skimmer weirs must be automatically adjustable and must operate freely with continuous action to variations in water level over a range of at least 4 inches. The weirs must operate at flow variations. The weir must be of such buoyancy and design so as to develop an effective velocity.

4. An easily removable and cleanable basket or screen through which overflow water passes must be provided to trap large solids.

5. The skimmer must be provided with a device to prevent air lock in the suction line. An equalizer pipe must be used and must provide an adequate amount of water for pump suction if the water of the swimming pool drops below the weir level.

6. The equalizer piping and fittings must be sized to meet the capacity requirements of the filter and pump and in no case be less than 2 inches in diameter. The pipe must be connected to the main drains. The equalizer float valve assembly must remain tightly closed under normal operating conditions but will automatically open when the water level drops below the lowest weir operating level.

7. The equalizer fitting must be a design that reduces the possibility of hair entrapment in the fitting.

8. The skimmer must be of sturdy, corrosion-resistant materials.

9. Each skimmer must be equipped with a variable orifice trimming device to allow balancing of flow.

10. Skimmers must be NSF approved.

11. Provide a solid aluminum or fiberglass lintel plate spanning the top of each skimmer throat opening in the pool wall to support the pool coping. Lintel to have dimensions of 7-3/4" by 2'-0" and be 3/8" thick. Aluminum lintel plates require bonding in accordance with NEC Article 680. Fiberglass lintel plates must be of rigid design with factory finished or field sealed edges to prevent exposed jagged surfaces and moisture intrusion into the fiberglass material.

2.02 PUMPING EQUIPMENT

A. Proposed substitutions must include a mechanical drawing incorporating required changes in layout, piping and valves. The cost of such changes must be included in the price of the substitute. Confirm correct pump motor voltage prior to ordering pump. Motors must be capable of continuously running without overloading at points on the characteristic curve of the pump without overload or damage. Confirm by 1/4-inch scale shop drawing that the pumps provided will fit within the available space and can be reasonably removed for servicing.

1. Pumps must be certified by the National Sanitation Foundation (NSF) and bear the certification mark.

2. If the pump is powered with a VFD, the impeller must be trimmed to a maximum diameter based on the most limiting condition of either the diameter of the maximum non-overloading rated motor horsepower at the design point or a diameter resulting in 10% greater head than the specified head.

3. Pump motor must be totally enclosed, fan cooled (TEFC) and premium efficiency of the horsepower and speed specified. A pump requiring larger horsepower is not acceptable unless submitted as a substitute and approved by the engineer, in which case necessary electrical revisions must coordinated and provided.

4. Entire pumping unit must be mounted on a base using cap screws to preserve the back-pull-out feature of the pump. Pumps must not be secured with floor studs or "all-thread". The pump base must be coated with the same epoxy coating as the pump. An OSHA approved guard must protect coupling and exposed rotating components of the pump and motor where required.

5. Recirculation and Feature Pumps – Metallic Components

a. Provide horizontally mounted centrifugal pumps as shown on the drawings and described in these specifications. Each pump must be of a straight centrifugal, end suction, bronze fitted, close coupled type.

b. Pumps manufactured by Paco, Griswold, Aurora or Herborner are considered equal, provided they meet the requirements.

c. Pump casing must be cast iron fitted with a replaceable bronze case wear ring. Mechanical seals must be provided specific for a chlorinated water application. Pump impeller must be enclosed type of cast bronze or 316L stainless-steel, statically, and dynamically balanced, and trimmed for the specified design conditions. If a VFD must be used in conjunction with a

pump, the impeller must be trimmed to the maximum diameter based on the rated motor horsepower. Bronze materials must be suitable for use in a chlorinated environment. Suction and discharge flanges must be provided and tapped for gauge connections. Provide steel or cast-iron bases with equivalent epoxy coating for corrosion protection.

d. Provide a fusion-bonded epoxy coating on wetted parts to protect pump internals from corrosion, including pump volute interior and complete pump impeller (bronze impellers only). Sandblast to bare, white metal. Thickness must be 8 to 12 mils (heavy film). Verify thickness by non-destructive testing. Coat parts as recommended by manufacturer, including preheating parts to 400 degrees and electrostatic deposition or fluidized bed technique. Provide primers if required to resist chlorinated water <10 ppm.

e. Provide a hair and lint strainer, for each pump, of fiberglass or epoxy coated stainless-steel construction with a clear observation top in the sizes (or pipe sizes) indicated on the drawings. Verify and coordinate pipe and pump suction sizes in the field. Strainer must be of a low pressure drop full-open or a tapered eccentric reducing type. Straight reducing type strainers will not be acceptable without the addition of an approved tapered eccentric reducer between the strainer and the pump (in which case, sufficient space in the pump pit must be verified). Provide a stainless-steel basket with at least 4 times the free open area as the inlet pipe, and one spare basket with each strainer.

1.) Basis of Design: As manufactured by MerMade Filter Inc., or Neptune/Benson Inc., or Fluidtrol Process Technologies, Inc.

f. Recirculation pumps must be provided by the same manufacturer. Confirm voltages prior to ordering pumps.

6. Recirculation and Feature Pumps – Composite Components

g. Provide horizontally mounted, self-priming, centrifugal pumps as shown on the drawings and described in these specifications. The pumps must be of a straight centrifugal, end suction, non-corrosive PPO Resin material construction, closed coupled type, with integral hair and lint strainer.

h. The pump body, seal plate, and attached hair and lint strainer must be constructed of non-corrosive PPO Resin materials, and close-coupled to an electric motor by means of an adaptor of the same material.

i. The pump must have a PPO Resin diffuser to aid in priming and it must contain a replaceable bronze wear ring for the impeller. The impeller must be of the closed type and PPO Resin, non-overloading at points on the performance curve. The mechanical shaft seal must be constructed of ceramic and carbon seal faces, with stainless steel, brass, and Buna N materials in the spring bellows portion. The impeller must be secured to the motor shaft by means of a stainless-steel key and locking screw into the end of the motor shaft. The pump must be capable of operating at up to 50 psi, 104° F continuous water temperature.

j. The electric motor coupled to the pump must be of the NEMA Rated series JM construction with stainless steel shaft inside a removable shaft sleeve of

300 series stainless steel. Motors must be continuous duty rated at 40° C (or realign better) ambient and be suitable for outdoor installation.

k. Pumps must meet Department of Energy (DOE) minimum efficiency standards for dedicated-purpose pool pump (DPPP) motors.

l. The pump strainer must consist of a PPO Resin body, Polycarbonate Resin Thermoplastic cover with O-ring seal, and Cam and Ramp™ Lid, and a strainer basket of mineral reinforced polypropylene material.

m. The strainer basket must be securely positioned below the suction inlet of the trap, with access for inspection and cleaning through a removable trap body lid. The trap body lid must be secured by means of a locking ring. Provide one spare basket for each strainer.

7. Other System Pumps and Motors

n. Provide one (1) portable utility pump(s). The pump(s) must be a 1 HP, 3600 RPM, 115-volt, 1 phase, 60 cycle unit capable of 60 GPM at 25 ft. TDH.

B. Variable Frequency Drive Starters

1. Provide variable frequency drive starters (VFD) for the pool pumps. Provide variable frequency drive starters (VFD) for pool recirculation pumps only (PP1). VFDs must be Eco-Flow-C by H2Flow Controls, AcuDrive by Pentair, GreenDrive by Neptune Benson, or approved equal.

2. Ensure that equipment is provided with the correct operating voltage and that interconnected electrical and electronic equipment must adequately communicate and operate the specified pumping equipment. Equipment installations must meet or exceed the requirements of the National Electric Code and other local and state regulations.

3. Variable Frequency Drive Capabilities

a. Provide complete VFD as specified herein or in the equipment schedule for loads designated that must be variable speed or variable flow.

b. The VFD must convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD must be a six-pulse input design, and the input voltage rectifier must employ a full wave diode bridge. The output waveform must closely approximate a sine wave. The VFD must be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform.

c. Indoor Applications: VFD must be fully enclosed in a corrosion resistant NEMA 12/IP54 UL listed enclosure.

d. VFD and required options will be incorporated by the VFD manufacturer into an integrated package, with a single input feed and main disconnect.

e. VFD must have a fused disconnect and battery back-up, for the purpose of maintaining programming in the event of a power outage.

f. The VFD must produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating.

g. The VFD must provide rated RMS fundamental output voltage. The VFD must utilize VVCPLUS, an output voltage-vector switching algorithm, or equivalent, in both variable and constant torque modes. This allows the motor to operate at a lower temperature rise, extending its thermal life.

h. The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis and be capable of running the motor at its nameplate RPM, voltage, current, and slip without having to utilize the service factor of the motor.

i. The VFD must offer a programmable motor parameter that allows the total number of poles of a motor that must be programmed to optimize motor performance.

j. VFD must automatically boost power factor at lower speeds.

k. The VFD will be capable of running either variable or constant torque loads. In either CT or VT mode, the VFD must be able to provide its full rated output current continuously and 110% of rated current for 60 seconds.

l. An Automatic Energy Optimization (AEO) selection feature must be provided in the VFD to minimize energy consumption in variable torque applications.

m. VFD must offer a motor spinning test that will run the motor at 5 Hz until the OK button is pressed. This feature will allow the user to determine if the motor is running in the correct direction.

n. Switching of the input power to the VFD must be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.

o. Switching of power on the output side between the VFD and the motor must be possible with no limitation or damage to the VFD and must require no additional interlocks.

p. An Automatic Motor Adaptation (AMA) function must measure motor stator resistance and reactance to optimize performance and efficiency.

q. Cooling must be via an aluminum heat sink and must prevent the introduction of ambient air to the electronics for cooling. With the exception of the water-resistant heat sink fan, electronics must be fully sealed within the enclosure.

r. The VFD must have temperature-controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.

s. VFD must provide full torque to the motor, given input voltage fluctuations of up to +10% to -10% of the rated input voltage.

4. Harmonics:

a. The VFD must provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor.

b. The VFD must be provided with line-side harmonic reduction, as required, to ensure that the current distortion limits, as defined in table 10.3 of IEEE 519-1992, are met.

c. Harmonic solutions must be designed to withstand up to 2%-line imbalances with the maximum Current Distortion not to exceed 11% at 100% load.

d. Harmonic solutions must be capable of withstanding up to 2% ambient voltage distortion with the maximum Current Distortion not to exceed 12% at 100% load.

e. Protective Features:

f. VFD must have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.3 msec.

g. VFD must include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

h. Printed Circuit boards must be conformal coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC 61721-3-3, Class 3C2 as standard.

i. Automatic "No-Flow Detection" must be available to detect a no-flow situation in pump systems where valves can be closed. This must be functional in closed loop control or when controlled by an external signal.

j. Dry-pump detection must be available to detect if the pump has run dry. If this condition occurs, the drive will be safely stopped. A timer must be included to prevent nuisance tripping.

k. End-of-Pump curve detection must stop motor when the pump is operating outside of its programmed pump curve.

l. VFD must provide a flow compensation program to reduce energy by adjusting the Setpoint to match changes in flow (friction loss).

m. VFD must include current sensors on three-output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

2. Interface Features:

a. VFD must provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.

b. VFD Keypad must feature an INFO key that, when pressed, must display the contents of the programming manual for the parameter that is currently viewed on the display.

c. VFD Display must have the ability to display 5 different parameters pertaining to the VFD or the load including: current, speed, DC bus voltage, output voltage, input signal in mA, or other values from a list of 92 different user-selectable parameters.

d. A red FAULT light, a yellow WARNING light and a green POWER-ON light must be provided. These indications must be visible both on the keypad and on the VFD when the keypad is removed.

e. Two-level password protection must be provided to prevent unauthorized changes to the programming of the VFD.

f. A quick setup menu with factory preset typical parameters must be provided on the VFD to facilitate commissioning.

g. A digital elapsed time meter and kilowatt hour meter must be provided in the display.

h. VFD must offer as standard an internal clock. The internal clock can be used for: Timed Actions, Energy Meter, Trend Analysis, date/time stamps on alarms, Logged data, Preventive maintenance, or other uses.

i. A battery back-up must be provided to maintain internal clock operation during power interruptions.

j. Inputs and outputs must be optically isolated.

k. The VFD must have two analog signal inputs. Inputs must be programmable for either 0 -10V or 0/4-20 mA.

l. One programmable analog output must be provided for indication of the drive status. This output must be programmable for output speed, voltage, frequency, motor current and output power. The analog output signal must be 0/4-20 mA.

m. The run permissive circuit must be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.

n. The VFD must be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port.

3. Adjustments:

a. The VFD must have an adjustable output switching frequency.

b. Four complete programming parameter setups must be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to program for up to four alternate control scenarios without requiring parameter changes.

c. In each programming setup, independent acceleration and deceleration ramps must be provided. Acceleration and deceleration time must be adjustable over the range from 0 to 3,600 seconds to base speed.

d. The VFD must have four programmable “Bypass frequencies” with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature must offer a Semi-Automatic program to simplify the set-up.

e. VFD must include an automatic acceleration and deceleration ramp-time function to prevent nuisance tripping and simplify start-up.

f. The VFD will include a user-selectable Reset function, which enables the selection of between zero and twenty restart attempts after a self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload, and motor overload), or the selection of an infinite number of

restart attempts. The time between restart attempts must be adjustable from 0 through 600 seconds.

g. An automatic "on-delay" function may be selected from 0 to 120 seconds.

h. The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD.

4. Individual VFD options such as bypass, motor selection contactors, etc. must be incorporated by the manufacturer onto a single panel with single input feed and main disconnect function. Enclosures must be UL listed and fully assembled by the VFD manufacturer.

5. Service Conditions:

a. The ambient operating temperature of the VFD must be -10ºC to 50ºC (14 to 122°F).

b. 0 to 95% relative humidity, non-condensing.

c. Elevation to 3,300 feet (1000 meters) without derating.

d. VFD's must be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -10% variations. Line frequency variation of ± 2% is acceptable.

C. Pump Gauges

1. Pressure gauges must be provided on the discharge of the pumps.

2. Compound gauges must be provided at the intake port of the pumps, after the hair and lint strainer.

3. Gauges must be liquid filled, 316L stainless-steel bourdon tube type with a minimum 2-1/2-inch diameter dial, high impact polypropylene or stainless-steel case, corrosion resistant white scale with black divisions and numerals, 300 Series stainless-steel heavy duty rotary bushed movement, black enameled balanced Micrometer pointer.

4. Scale ranges must be selected to indicate the normal system operating pressure of each system or location within the system. Pressure ranges must be calibrated in psig (0-60 psi) and compound gauge must be calibrated in inches of mercury (0-30 in Hg / 0-60 psi).

5. A stainless-steel filter type pressure snubber must be provided for each pressure gauge consisting of a 3/8-inch diameter by 1/8-inch-thick micro metallic stainless-steel filter and placed in the line just before the pressure gauge. Provide isolation brass valves or brass gauge cocks at each gauge for easy replacement and maintenance.

2.03 FILTRATION EQUIPMENT

A. The filter system must consist of high-rate pressure sand filter tanks as shown on the drawings. Every aspect and component of the filter system must be certified by the National Sanitation Foundation (NSF) and bear the certification mark. The filter must have an engraved metal data plate permanently affixed on the face of the system that describes operational data and instructions and indicates startup date.

B. It is the intent of these specifications to describe a filtration system complete in every respect with accessory items and supplied and warranted by one manufacturer.

C. Horizontally Oriented Fiberglass Tanks

1. The filter tanks must be horizontally oriented single cell fiberglass tanks, minimum 30 inches in diameter. The filter system must be listed as approved by National Sanitation Foundation prior to bid date.

   a. Fiberglass filters must be the product of Pentair, Waterco, or Neptune Benson provided they meet the specifications and layout. System design based upon Pentair. Valves must be provided to backwash one filter at a time.

2. Filter tanks must incorporate components and feature as described in this section.

3. Two (2) saddle style bases must be provided for tank support. Systems that incorporate stacked tanks must include similar bases and mounting saddles for the upper vessel. Tank supports and connections must be seismic rated to support the filter tank(s) for the appropriate seismic zone where the project is located. Access to the tank must be provided by a 14" x 18" manhole with two (2) curved yokes. Manhole seal must be complete with a one-piece 1/4" neoprene gasket and positioned so that internal pressure from the filter will augment the seal. No additional hardware or through bolts will be allowed.

4. Each filter tank must be equipped with the necessary flanges and connections for the internal and external piping. Connections must be comprised of fiberglass flanges and schedule 80 PVC flanges.

5. Tank connections 2 inches and smaller must be 150 lb. Type 316L stainless-steel threaded full couplings. Tank connections 3 inches and larger must be heavy steel bosses drilled and tapped both sides to receive standard flanged fittings or Sch. 40 Type 316L stainless-steel nipples.

6. The discharge from the automatic air release valve must be hard piped to waste. Each filter tank must have a means of releasing air. Each coupling or orifice must be provided with a slotted PVC sand retainer or stainless-steel strainer. An automatic air release system must be provided for each tank.

7. The drain system must consist of a 3/4-inch 316L stainless-steel coupling mounted at the lowest point in the bottom head. This drain must be valved and piped to the nearest floor drain or backwash pit.

8. Filter Piping - Internal

   a. The lower internal distribution system must be a horizontal header/lateral arrangement. The header must be Schedule 80 PVC construction, capped on one end and flanged or threaded at the other end for field connection. Lateral connections must be spaced no more than 6 inches on centers and must be 1-1/2-inch FPT connections. Attachments to header must be solvent welded and thermo-welded to ensure integrity of connection.

   b. Under drain system must be factory installed and constructed of extra heavy Schedule 80 high impact PVC. Multiple PVC main headers must be tapped and threaded to receive laterals.

c. Laterals must consist of 1-1/2-inch Schedule 80 PVC pipe with openings as required. Each lateral must be fabricated complete with socket cap on one end and male adapter on the other end. Both fittings must be solvent welded to the slotted pipe. Laterals must be designed and sized at the factory, so they are installed in the field and over the entire cross sections area of the filter.

d. The upper distributor must consist of PVC piping Schedule 80 and/or deflector plate per manufacturer standard design.

e. Each filter must be supplied with a pressure equalizing upper internal distribution system consisting of a horizontal header/lateral arrangement. The header piping must be constructed of Schedule 80 PVC. The header/lateral piping and connections must be designed and sized to provide uniform distribution and unrestricted flow during the filtration and backwash cycles.

f. Upper laterals must be constructed of Schedule 80 PVC pipe with machine slotted openings or orifices. Machined slots or orifices must be clean, de-burred and free of obstructions that would not permit the free flow of water through the opening. Details of the lateral attachment to the header must be submitted for review and approval.

g. The lower and upper distribution systems must be properly supported and anchored. Hardware in wetted areas must be Type 316L stainless-steel or non-metallic. Tank interiors must be inspected prior to the media being placed in the filters.

9. Filter Piping - External (Face)

a. External face piping must be Schedule 80 PVC pipe and fittings. Flanges must be located so as to allow for easy dismantling of face piping. Fittings must be solvent cemented.

b. Piping must be drilled and tapped where necessary to accommodate gauge tubing connectors.

c. Valves 3" and larger must be constructed with cast aluminum S12A alloy (as defined by ASTM B275) housing and fully coated with Rilsan on interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and 316L stainless-steel shaft. Valves must be rated for 150 psi bubble tight shutoff. Unless otherwise specified, nuts and bolts must be stainless-steel with stainless-steel washers and used when secured to PVC flanges. Systems incorporating solenoid, pneumatic, pressure amplified, hydraulic or multi-directional valves are not acceptable.

d. Standard accessory items must include sight glass rated for 50 psi with polycarbonate glass, remote mounted gauge panel with two 4½" diameter pressure gauges, ¼" petcocks, ¼" poly vent tubing with PVC compression adapters.

10. Backwash Control

a. The filter manifold face piping must be designed to allow for one (1) filter tank to backwash at a time while the recirculation system is operating. A manual backwashing system must be provided with the filter system.

b. Manual Backwash System

c. The manual backwash system must be equipped with a face piping configuration such that the operator must be manually control and operator both the time and sequencing of the backwash cycle. Valving on the filter face piping must be a mechanical linkage device allowing the operator to simultaneously move two (2) valves at once. Mechanical linkage components must be PVC or Type 316L Stainless-steel.

11. Automatic Air Relief Valve

a. A 1” valve must be provided to automatically and continuously release air in the filter. The valve must be fabricated of plastic with Buna-N seals. A plumbing kit must be provided with two (2) PVC ball valves to allow manual air relief and isolation of the automatic valve. Valves fabricated of cast iron, bronze or stainless-steel valves will not be accepted.

12. Filter Media

a. Filter media must be a carefully selected grade of hard uniformly graded silica material. Media must be milled angular shaped particles of silica quartz. The filter sand must have a particle size between 0.45 mm and 0.55 mm and have a uniformity coefficient not to exceed 1.53. Specific gravity must not be less than 2.5 with a pH of 7.0.

b. Media (sand) must be cleaned and free from clay or limestone deposits. Bottom layer of support media must be placed by hand to avoid damage to the under-drain system and leveled before the addition of the upper layer of filter media.

c. Media must be delivered after approval by the manufacturer of the filter and stored in 100-pound bags for ease of handling and elimination of possible contamination.

d. Media must be supplied by the filter manufacturer and approved by the filter manufacturer prior to shipping.

13. Support Media

a. A Gravel support media of a hard-coarse aggregate with a sub-angular grain shape with a particle size of 1/8" x 1/4" must be used on the inside of the bottom head to the elevation where the filter media commences. The specific gravity must not be less than 2.5. Support media must be placed by hand to avoid damage to the under-drain system and leveled before the addition of the upper layer of filter media. Concrete under fill is not recommended. Support gravel must be delivered and stored in 100-pound bags (approximately one cubic foot) for ease of handling and elimination of possible contamination. Media must be free from minerals which can precipitate onto pool surfaces.

b. Sand must be a carefully selected grade of hard, uniformly graded silica material. Media must be naturally rounded particles of silica or milled angularly shaped particles of silica quartz. Sand must have a particle size

between 0.45mm and 0.55 mm (#20). No more than 1.5% is allowed to pass through a #40 sieve (.0164”). Uniformity coefficient must not exceed 1.53. Specific gravity must be not less than 2.5. Filter must contain a minimum bed depth as recommended by the manufacturer. Systems which do not provide a minimum bed depth will not be accepted. Sand must be delivered and stored in 100-pound bags (approximately one cubic foot) for ease of handling and elimination of possible contamination. Media must be free from minerals which can precipitate onto pool surfaces.

2.04 RECIRCULATION FITTINGS

A. Main drains must be Fiberglass box with PVC grating as sized on the drawings. Grate openings must not exceed 11/32 inch in width, providing an open flow area to allow water velocity not to exceed 1.5 fps. The grate must be PVC and fit closely and flush with top surface of frame and secured to frame with vandal proof fasteners. Exposed edges of main outlets must be rounded and smooth, free of burrs and sharp edges. Main drain covers must comply with the Virginia Graeme Baker Act and ANSI/APSP-16 2017.

B. PVC channel drains and covers must be provided as sized on the drawings. Channel drains must comply with the Virginia Graeme Baker Act and ANSI/APSP-16 2017.

C. Wall inlet fittings must be cycolac directional inlet Hayward model #SP-1421-E (1” opening) mounted in model #SP-1022S) or equal product from Aquastar or Sta-Rite.

D. Static water line inlet fitting for the automatic water level controller must be provided consisting of a cycolac body, grate, and construction shield. The body must have a 1-1/2-inch solvent weld connection and provided with an integral molded "knock-out" membrane to facilitate line pressure testing.

E. The outlet fitting grate from the fill funnel piping to the pool must be a 9” x 9” cycolac frame and grate.

2.05 PIPING SYSTEMS

A. General

1. Provide recirculating piping between the `pool and the filter room, fill receptor and interconnecting piping to and from the chemical feed systems and chemical controller.

2. Provide necessary pipe supports and support systems required to support associated piping and valves.

3. Provide other tubing, conduit, or piping associated with equipment specified herein. Coordinate with other trades.

B. Pipes

1. Pipe routing as shown and detailed on the contract drawings is diagrammatic only and is not intended to show minor details or exact locations of piping systems. Installation is required and must be adjusted to accommodate interference and adjustments anticipated and encountered. Pipe sizes on plans refer to nominal inside diameter of the pipe.

2. PVC swimming pool piping must be NSF approved and conform to the requirements of ASTM D-1785.

3. PVC pipes must be the product of one manufacturer. Approved manufacturers of PVC piping are Eslon, Harvel, and Chemtrol or approved equal.

4. Swimming pool piping above the floor or deck in the filter room must be Schedule 80 PVC.

5. Swimming pool piping below the filter room floor or deck must be NSF approved, Schedule 80 PVC.

6. Swimming pool piping under the pool floor must be NSF approved, Schedule 40 PVC and concrete encased. Transitions between Schedule 40 and Schedule 80 must be encased in concrete.

7. Swimming pool piping under the pool floor must be NSF approved, Schedule 80 PVC that is backfilled within a 3/4" minus fine crushed aggregate conforming to ASTM C136. Fill material must be submitted to the Architect for review and approval prior to placement of below grade pool pipe.

8. Below grade swimming pool piping not located beneath the pool floor can be backfilled with native granular material free of ice, clay, debris, organic matter, and rocks larger than 4" across their greatest dimension.

9. The influent and effluent lines to the heat exchanger unit must be CPVC. Connections between metallic piping and/or equipment and PVC must be flanged.

10. PVC and CPVC fittings must be the product of one manufacturer. Molded fittings must be as manufactured by Asahi, Eslon, Chemtrol, Harvel, Spear, Lasco or acceptable substitute.

11. Vertical sight sump piping must be NSF approved, Schedule 40 PVC. Horizontal sight sump piping must be NSF approved, Schedule 40 PVC that is perforated and wrapped with fabric and have 3/8" diameter holes located top and bottom on 4 ft centers. Horizontal sight sump piping must extend 1 ft minimum beyond the main drain.

12. Chemical feed lines from chemical feeders to recirculation piping must be Schedule 80 PVC piping. Piping must be hard piped into the recirculation piping via tee or saddle per the drawings. Required valves must be of PVC construction.

13. Splash collar(s) for the fill funnel(s) must be clear Schedule 80 PVC and manufactured from a Type I, Grade I PVC compound with a Cell Classification of 12454 per ASTM D1784. The pipe must be manufactured in compliance to ASTM D1785.

14. Flanged plumbing connection hardware must be stainless-steel.

15. Materials must be installed by workmen thoroughly skilled in their trades and work must present a neat and mechanical appearance when complete. At no additional expense to the Owner, replace or correct work not judged acceptable by the Architect, Owner's testing agency, or their consultants.

16. Support hardware, brackets, fasteners, hangers, etc. furnished and installed in the surge tank must be 316L stainless-steel.

17. No installation allowed that will provide a cross-connection or interconnection between a distributing supply for drinking purposes and the swimming pool, or

between the pool and a sanitary or storm water sewer system that will permit a backflow of water into the pool water system.

18. Piping must be hydrostatically (water) pressure tested for leaks before and after backfilling to guarantee water tightness. Pneumatic (air) pressure test not allowed.

19. Provide water seals for watertight penetrations of concrete walls and floor slabs.

    a. Pool Concrete: Water seals must be coupling or sleeve type with a thermo welded or molded flange and the O.D. must be sized to 150% of the O.D. of the pipe. The thermo-welded type must be welded from both sides. Water seals must be located at the centerline of the wall or slab being penetrated prior to placing the concrete to assure a watertight seal. Manufactured fiberglass and PVC water seal fittings by Daldorado, A.S.A. Manufacturing, Aqaulogic or approved equal.

    b. Pump Pit: Link seals must be provided in the sizes and quantities shown on the drawings and installed to provide a flexible watertight penetration. Metal parts must be made of 316L stainless-steel. Links must form a continuous rubber seal that is tightened with a series of stainless-steel bolts to form a watertight seal. Link seals must be installed with either a cored hole or a pipe sleeve.

    c. Renovation:

    1) For wall penetrations with dry-side access (Mechanical Room/Pipe Tunnel), provide Link Seals with bolt head access from the dry side, Xypex Patch and Plug (on the wet side), Xypex Concentrate and Dry-Plug, and Xypex Megamix II or Non-Shrink Grout, or approved equal.

    2) For wall penetrations with no permanent dry-side access, provide Synkoflex FR Waterstop (trim as required), Xypex Patch and Plug, Xypex Concentrate and Dry-Plug, and Xypex Megamix II or Non-Shrink Grout, or approved equal.

20. Adhere to the applicable provisions in Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.

21. Mechanical equipment must be connected into the recirculation piping system must be connected utilizing flanged or union connections.

22. Provisions must be made to purge pipes in the system.

23. Concentric reducers must be fiberglass or approved equivalent reducers of schedule 80 PVC construction.

C. Pipe Hangers and Supports

1. Manufacturer

    a. Subject to compliance with these specifications, pipe hanger and support systems must be manufactured by Cooper B-line Inc, TOLCO, and Anvil International or approved equal.

2. Hangers

    a. Pipes 2 inches and smaller

    3) Adjustable steel clevis hanger.

4) Adjustable steel swivel ring (band type) hanger.

b. Pipes 2-1/2 inches and larger

1) Adjustable steel clevis hanger, B-Line model B3100 or approved equal.

2) Adjustable steel yoke pipe roll, B-Line model B3114 or approved equal.

3. Multiple or Trapeze Hangers

a. Trapeze hangers must be constructed from 12-gauge roll formed ASTM A1011 SS, Grade 33 structural steel channel, 1-5/8 by 1-5/8-inch minimum, or stronger as required.

b. Mount pipes to trapeze with 2-piece pipe straps sized for outside diameter of pipe.

4. Wall Supports

a. Pipes 2-1/2 inches and smaller

1) Steel offset "J" hook hanger.

b. Pipes 3 inches and larger

2) Welded strut bracket and pipe straps.

5. Welded steel bracket.

6. Floor Supports

a. Electroplated carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. Pipe saddle must be screwed or welded to appropriate base stand.

7. Vertical Supports

a. Steel riser clamp sized to outside diameter of pipe.

8. Plastic Pipe Supports

a. V-Bottom clevis hangers with galvanized 18-gauge continuous support channel, to form a continuous support system for plastic pipes smaller than 1 inch or flexible tubing.

b. A vented and sloped continuous PVC Schedule 40 pipe no smaller than 1-1/2 inch outside diameter will be used to route flexible tubing with the appropriate pipe supports.

9. Supplementary Structural Supports - Design and fabricate supports using structural quality steel bolted framing materials. Channels must be roll formed, 12-gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch or greater as required by loading conditions. Submit design for pipe tunnels, pipe galleries etc. for approval. Use clamps and fittings designed for use with the strut system.

D. Hanger Attachments

1. Upper Attachments

a. Beam Clamps

1) Beam clamps must be used where piping must be suspended from building steel. Clamp type must be selected on the basis of load supported and load configuration.

2) C-Clamps must be locknuts and cup point set screws. Top flange c-clamps must be used when attaching a hanger rod to the flange of structural steel. Refer to manufacturer's recommendations for set screw torque. Retaining straps must be used to maintain the clamp position on the beam where required.

3) Center load beam clamps must be used where specified. Forged steel beam clamps with cross bolt to fit beams.

b. Concrete Inserts

1) Cast in place spot concrete inserts must be used applicable, either steel or malleable iron body. Spot inserts must allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rods sizes.

2) Continuous concrete inserts must be used where applicable. Channels must be 12 gauge, ASTM A1011 Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert must have a load rating of 2,000 lbs/ft. in concrete. Select channel nuts suitable for strut and rod sizes.

E. Hanger Accessories

1. Hanger rods must be threaded on both ends or continuously threaded rods of circular cross section. Use adjustable lock nuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

F. Hanger Finish

1. Indoor Finishes

a. Hangers must be zinc plated in accordance with ASTM B633 or must have an electro-deposited green epoxy finish.

b. Strut channels must be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 or must have an electro-deposited green epoxy finish.

c. Zinc Plated hardware is not acceptable for use in chemical rooms.

G. Valves

1. Valves 3 inches and larger must be butterfly type valves, with PVC body, 150# SWP with stainless-steel shaft, PVC or polypropylene disc and replaceable resilient seat bonded to a rigid shaft and guaranteed for bubble tight shutoff from 27-inch vacuum to 150 PSI. Extended neck 2 inch beyond flanges for insulated piping must be provided with handle for manual operation. Valve components must be suitable for swimming pool chlorinated water service. Butterfly valves must be Georg Fischer Type 563, Asahi/America Type SP Pool-Pro, Chemtrol Model-B, Simtech VP series, Colonial Valve 411 Series, or approved equal.

2. Valves smaller than 3 inches must be PVC true union ball valves, full port, three-piece construction, blowout-proof stem, Viton seal with socket end connectors.

3. Check valves must be a quick closing non-slam type, either self-aligning wafer or flanged type, of corrosion resistant materials suitable for use in a swimming pool environment. Provide check valves in accordance with the manufacturer's recommendations. Locate check valves at least 5 pipe diameters from pumps and fittings. Check valves must be epoxy coated cast iron body and bronze swing plates on a stainless-steel spring, with EPDM O-ring and stainless-steel spring, for installation between 150 lb. flanges.

4. Submerged valves up to 3 inches must be PVC true union ball valves. Submerged valves over 3 inches must be PVC bodied, wafer type, butterfly valves with stainless-steel handle extensions as required. Valves must be by approved manufacturers listed above. Submerged valves must be provided with stainless-steel connectors. The stem housing extensions must be properly supported and braced.

5. Butterfly type valves 8 inches and larger must be fitted with a watertight gear operator.

6. Valves located 7 feet or greater off the floor must be fitted with a chain operator.

7. Submerged valves, valves buried below grade, or valves not readily accessible, must be provided with a stainless-steel reach rod and handle.

8. Valve hardware must be 316L stainless-steel and meet ANSI hardware installation guidelines.

H. Pipe and valve identification

1. Exposed pool piping must be equipped with color coded flow directional arrows at thirty (30) inch intervals per local and state swimming pool health code. Verify that pool piping identification is in accordance with local and state health regulations.

2. Valves must be identified with minimum 1-1/2-inch diameter brass tags stamped with minimum 1/2-inch-high numbers and attached to valves with #16 brass jack chain. (Plastic laminate engraved tags with nylon attachment acceptable.) Valves must be described as to their function and referenced in the operating instruction manual and wall mounted piping diagram that must be prepared.

2.06 CHEMICAL TREATMENT SYSTEMS

A. Calcium Hypochlorite (Chlorine Tablets)

1. Shop drawings complete with a piping diagram depicting the location in which the dry chlorination feeder is connected to the system must be provided and approved prior to installation. Installation of the system must be as specified in the manufacturer's directions with no exceptions taken.

2. A factory-authorized representative must provide training to the owner and the training must be video recorded per 131100, Section 1.12 of the project contract documents.

3. General Description

1) The system must be designed to feed low concentrations of calcium hypochlorite in solution intermittently or continuously as required for pool applications. The system must be a single pre-assembled, package unit with a welded aluminum frame consisting of chlorinator, electrical box,

centrifugal pump, and solution tank for ease of installation and operation. Specific calcium hypochlorite tablets must be used with the manufacturer selected.

2) System must use an NSF Standard 50 listed erosion feeder and tablet combination and must be capable of meeting requirements of the Health Department having jurisdiction over the installation.

a. System Features

1) A maximum chlorine solution level of 0.05% (500 ppm) must be maintained to prevent calcification in system components. Systems producing chlorine concentrations higher than 0.05% are not acceptable.

2) Delivery must be by erosion feed technology to control accurate and consistent concentration limits in the chlorine treatment solution. Soaking type, spray and/or vortex technology systems are not acceptable.

3) The chlorinator must automatically and continuously feed a limited quantity of chlorine in solution as needed; when the system is not running, no more chlorine than that amount which can be fed in one minute or less must be left in the tank to prevent dilution. Batch systems preparing excess quantities of solution for delivery over an extended period are not acceptable.

4) A centrifugal pump wired to the system electrical box must feed freshly mixed chlorine treatment solution only as required for maximum efficiency. Batch systems requiring the use of a metering pump or pumps to feed pre-prepared standing solution are not acceptable.

5) Piping in the chlorinator unit must be Schedule 40 PVC. Systems with flexible tubing are not acceptable.

b. System Components

1) Tablets are placed on a sieve plate inside the chlorinator; as water flows across the sieve plate, the tablets erode at a rate proportional to the flow rate. Chlorine product will be specific to manufacturer selected.

B. pH Buffering System ((Sodium Bisulfate (Dry Acid))

1. Shop drawings complete with a piping diagram depicting the location in which the dry acid feeder is connected to the system must be provided and approved prior to installation. Installation of the system must be as specified in the manufacturer's directions with no exceptions taken.

2. General Description

1) The system must be designed to erode tablets, creating an acid solution, and feeding the solution intermittently or continuously as required for pool applications. The system must be a single pre-assembled, electrical box, centrifugal pump, and balance tank for ease of installation and operation. The selected system will have a specific sodium bisulfate product that must be used.

2) System must use an NSF Standard 50 listed erosion feeder and tablet combination and must be capable of meeting requirements of the Health Department having jurisdiction over the installation.

C. Ultraviolet Dechloramination and Disinfection System

1. Medium Pressure UV

a. Ultraviolet Disinfection Equipment: Must operate within the UVC electromagnetic spectrum emitting wavelengths in the range of 200nm to 400nm. This required wavelength will provide constant disinfection/inactivation of bacteria, algae, molds, viruses, and destruction of Monochloramines, Trichloramines, and Dichloramines.

1) Ultraviolet disinfection equipment by Evoqua, Aquionics, Prominent, or approved equals.

b. The UV System must have a MET or equivalent (ETL, CSA, or UL) listing, be NSF-50 2016 certified including Section 14.18 (crypto inactivation) and 3rd party validated to the USEPA UVDGM 2006 Guidelines.

1) Equipment General Description: The Ultraviolet System and Commissioning must be provided in a complete package to include a stainless-steel chamber, Control System located in NEMA 12 (IP52) rated panel, Medium Pressure Bulb(s) designed to emit wavelengths within the UVC electromagnetic spectrum, automatic wiper system, and Project Commissioning by a Certified Ultraviolet Technician.

c. Wafer (WF) Units: Ultraviolet manufacturer to offer unit capability of a horizontal OR vertical installation application using state of art design and direct flow through characteristics. Unit must be a medium pressure system with 94% UVT at the indicated design flow rate. Systems validated or designed for flows based on 98% UVT are not acceptable. Chamber and Control Cabinet must be as indicated on the drawings.

d. Ultraviolet Lamp

1) Ultraviolet lamp must be medium pressure high intensity. Lamp must be designed to emit continuous Ultraviolet wavelengths in the range of 200nm to 400nm. This will provide optimal disinfection benefits and destruction of the Monochloramine, Dichloramine, and Trichloramine compounds. The lamp(s) must remain unaffected by temperature variance of 0 degrees F (-17 C) to 200 degrees Fahrenheit (93 degrees Celsius).

2) The lamp system must provide a constant dose of not less than 60 mJ/cm2 until the end of the lamp life for indoor applications and not less than 40 mJ/cm2 for outdoor disinfection and this must be based on constantly monitoring the full recirculating flow rate, not on a side stream treatment. The system must be equipped with infinitely variable power control of the lamp intensity & dose. Power stepping not acceptable. The lamps must be capable of turndown to 30% of the nominal rated power.

3) The lamp must be connected via means of a plug connector and must have a mechanical interlock to prevent lamp removal when lit for safety reasons.

e. Ultraviolet Reactor

1) The unit must be constructed of 316L stainless steel electropolished and passivated to prevent corrosion within the harsh pool environment.

2) The Ultraviolet chamber must come complete with the following equipment: Ultraviolet intensity monitor factory calibrated to provide intensity in mWcm2, monitors providing percentage of lamp output not acceptable. It must include a built-in alarm system to notify operator when output level drops below required level of 60 mJ/cm2 for indoor pools or 40mJ/cm2 for outdoor pools (or operator set dosing levels).

3) UV Reactor will be a validated system with third party testing to a recognized international standard such as the USEPA DGM.

4) Ultraviolet temperature monitoring system must be provided to maintain system integrity in the event of flow interruptions to the chamber.

5) Ultraviolet chamber must come complete with annealed quartz sleeve with "O" ring seals for water tightness. System must be complete with advanced seal arrangement to reduce risk of quartz over-compression on the seal face.

f. Automatic Wiper System

1) An automatic cleaning system must be provided for cleaning of quartz sleeve and Ultraviolet monitor probe. The system must travel the entire length of the quartz sleeve twice per desired cleaning cycle. Precision molded wiper rings must be provided to ensure thorough quartz tube cleaning and quartz tube protection. Wiper cycle must be user selectable and adjustable within a range of 5 minutes to 24 hours depending on anticipated application and deposit build-up.

2) The wiper system must have the following characteristics:

a) System must utilize direct drive with square faced coupling and acme threaded shaft to prevent slippage and pin shearing. Systems utilizing shear pins or complicated gear boxes will be unacceptable.

b) Wiper power supply must be 24-volt DC for improved safety. Higher voltage not acceptable.

c) System must incorporate Direct Shaft Encoding for positional location. Systems relying on external limit switches or internally located magnets will be unacceptable.

d) Wiper interval must be operator selectable with optional override switch.

e) Wiper faults must be indicated on the control system display.

f) Wiper System to utilize "Intelligent Operation" for automatic start-up commissioning.

3) Records wiper position at chamber ends. Position must be fixed and not dependent on a timed interval or component striking end of chamber.

4) Establish a travel run without using limit switches to ensure system integrity and longevity.

g. UV Strainer

1) The UV system must be provided with a downstream strainer to protect against the possibility of lamp/quartz breakage traveling downstream.

h. Ultraviolet Control System

1) The power must be controllable to provide full power, half power and infinite variable power based on real time interface with changes in UVT, Flow Rate or Combined Chloramines. The power panel must house the electronic ballasts required to ignite and power the lamps.

2) Three levels of operation must be provided to meet the needs of the operator and pool environment: Simple Control (start, stop and reset), Full Parameter Display, and Customized Operator Configuration.

3) Modes of operation must be password protected to secure system critical setup functions. Touch Control system must have clearly identifiable start, stop, and reset icons (suitable for gloved operation) with Running and Fault LCD indicators.

4) The display must include the following:

a) Ultraviolet calculated dose

b) Ultraviolet intensity (as a % and mW/cm^2)

c) Lamp Current

d) Flow rate (as gallons per minute or m^3/hour)

e) Chamber Temperature

f) Operation hour meter

g) Fault indicators to include Lamp fault, low UV & temperature alarm, ground fault trip, wiper fault.

h) Alarm functions must have simple text message display to assist in fault finding.

i. Ultraviolet Control System Interface

1) The Control system must have a minimum of the following system interface control:

a) Remote operation

b) Process interrupt features (from valves & flow meters)

c) Low UV dose

d) Flow meter input

e) Auto-Restrike.

f) Half to full power UV setting with 24 hour/7 day settable timer.

g) Variable power/Dose pacing interface

2) Control system must have built in data-logging capabilities to record the following information:

h) UV intensity required.

i) UV intensity measured.

j) Lamp current

k) Chamber Temperature

l) Flow Rate

m) Time and date stamp, every alarm generated.

j. Manufacturer must maintain spare or replacement parts in the USA for same day or not longer than next day delivery in North America.

2.07 WATER CHEMISTRY MONITORING AND CONTROL SYSTEMS

A. A programmable pool chemical automation system must be provided for continuous monitoring and control of the `pool water chemistry and related disinfection equipment. Installation of the system must be per the manufacturer's specification. A factory trained/authorized representative must provide training to the Owner and the training must be video recorded per 131100, Section 1.12 of the project contract documents. Water chemistry controllers must be provided by ProMinent Fluid Controls, BECS Technology, SB Control Systems, or a technically equal system capable of providing equal performance for operating functions.

B. The water chemistry control systems for the pool must feature and be capable of the following. Water chemistry controllers without these capabilities and features are not considered equal.

1. Continuous, real-time monitoring and control of pH and ORP.

2. Free chlorine in PPM.

3. Actuating outputs in the following operator selectable modes: off, manual, automatic, proportional and must have a manual on fail-safe timer to ensure that if the controller is left in manual mode, the controller will revert back to automatic mode to prevent an over-feed event.

4. Provide use of flow signal as a supplemental chemical feed interlock to prevent the dosing of chemicals during a system low flow/no flow condition.

5. Programmable high and low alarm levels for control functions with operator-selectable feed lockout and alarm buzzer options.

C. Performance and Certifications

1. The controller system must be NSF/ANSI 50 listed for automatic controller equipment for swimming pools, spas, and other recreational water facilities.

2. The controller system must be certified to UL61010/IEC61010 standards.

3. The controller must automatically activate the appropriate chemical feeders in order to maintain the sanitizer/oxidizer level:

a. Within +/- 0.1 parts per million (PPM) or +/- 10 mV (millivolts) of oxidation reduction potential (ORP)

b. The pH within +/- 0.1 pH unit of the set points selected by the operator.

c. Set point and calibration levels must be adjustable with a keypad mounted on the front panel of the unit as well as the remote interface.

d. The controller must use pH sensor with +/- 0.04 accuracy in the operational range of 6.8 – 8.2 as certified by NSF.

e. An ORP sensor with an accuracy of +/- 3% mV as certified by NSF.

D. System Supply

1. The controller must be factory supplied with:

a. ORP, pH, free chlorine sensors.

b. A flowrate sensor to measure system flowrate.

E. Hardware

1. The controller must have:

a. A minimum of two (2) fully configurable digital inputs.

b. A minimum of two (2) fully assignable digital outputs.

c. A minimum of two (2) configurable analog inputs.

d. A minimum of three (3), 115 VAC fully assignable relays.

e. The controller must be capable of expanded capabilities with an optional input/output expansion card kit.

f. The controller must include a sensing flow cell that is hydraulically designed to allow verified correct flow and consistent pressure across sensors. Flow cell will be clear PVC that is modular in concept and have the flexibility to add supplementary water chemistry sensors as desired. The sensing flow cell must include a safety flow switch sensor, water spigot, and isolation valves.

F. Communications

1. The controller must have as a standard feature:

a. Controller must include the capability of ethernet connection and secondary wireless communication.

b. The controller must allow full two-way remote communication and full control of parameters.

c. Accessibility with a standard internet browser using a fully interactive Ethernet TCP/IP graphical interface that includes security access codes.

d. Real-time monitor/control with real-time auto polling, data logging, email and text alarms and providing both graphical and report formats via a personal computer, smartphone, or tablet device. Controllers that require software or apps for communications are not considered an equal.

e. Controller must have the ability to facilitate email or text alarm notifications, historical graphing, and real-time control via a personal computer, smartphone, or tablet device.

f. Controller must have the ability to export a .csv file once per day with reading type, time, and reading. The export must be done via email and must include the controller serial number. Export data must include ORP, Free Available Chlorine, pH, and Temperature.

g. The controller must have the ability to allow software upgrades and programming as needed in the field.

G. Commissioning and Manuals

1. The control system must be provided with on-site start-up operator training performed by a representative trained and authorized by the controller manufacturer.

2. Manufacturer must supply an operation and maintenance manual describing features, operating instructions, maintenance procedures and replacement parts.

3. Installation of the system must be per the manufacturer's specification and no exceptions must be allowed. A factory trained/authorized representative must provide training to the owner and the training must be video recorded per 131100, paragraph 1.12 of the project contract documents.

2.08 FLOW METERS

A. Flow Meter

1. Flow meters (1 required) must be provided according to the manufacturer in the filtered water return lines to each of the pools. Provide the coaxial cable from the sensor to the display/transmitter. Flow meter accuracy must be +/- 2% of reading. The flow instrument must have an LCD for simultaneous display of four-digit flow rate and eight-digit totalizer. Display/Transmitter capability will be part of chemical controller function or as separate display/transmitter. Display/Transmitter must be powered by 24VDC and provide a 4-20mA output.

2. Backwash piping flow meter (1 required) must be a pilot, impact ball, variable area type with one piece, impact resistant machined acrylic plastic body. GPM scale must be permanently etched or imprinted on the meter. Flow rate indicator must be of stainless-steel material. Scale range must be appropriate for specific flow rate. Pipe size to accommodate backwash rate.

2.09 WATER LEVEL CONTROLLERS

A. In Mechanical Room – Wet Well Water Level Controller

1. Provide a water level sensing and control system for the pool that will monitor the water level in a well located in the mechanical room and which will automatically activate the auto water make-up control valve. For sensing water level and activating make-up water control valve for each pool, use Controller housed in a watertight NEMA 4X UL94 5V UL flammability rated polycarbonate enclosure to meet IP66 and NEMA 4, 4X, 12 and 13 ratings. The Controller must utilize two sensors to control water level. ELC-810 series must have a menu- driven LCD display screen and utilize a five-switch user interface for navigation through the menu. The menu must allow changing the following settings: delay to shutoff, alternate sensor option, maximum time on, manual override, delay to normal, type of sensor, high level option, flow sensor active, and sounder with alarm. Menu settings must be capable of password protection. The Controller must be capable of displaying the following data: last fill time, last drain time, last alarm. The Controller must be capable of determining the following: maximum time on exceeded, over current to solenoid valve, no valve/valve wiring problem, and sensor not working properly. The Controller must interlock with auto water make-up solenoid valve and must provide adjustable time delay for increasing level and manual override; 115 VAC, 1 phase, 60 Hz.

2. Provide a solenoid valve for high level sensor, normally opened, stainless-steel fitted, bronze body, 24 VAC slow closing type. Size to pipe. Interlock with automatic water level control system.

3. Provide a proximity switch sensor that must be sensitive to within +/- 1/8" (4mm) of nominal water level. Supply voltage to sensor must be 12V to 24V DC from Controller. Current consumption must be < or = 15mA. Response frequency must be 100Hz. Maximum control output must be 200mA. Sensor operating temperature must be -25 Deg. C to 70 Deg. C. Operating humidity must range from 35% RH to 95% RH. Sensor must be mounted in a 1" SCH80 PVC pipe 3 feet in length – the sensing pipe to then be mounted into a static line from the pool. The sensing pipe must be mounted into the static line via an adjustable collar that allows for quick level adjustments.

4. Wiring from the sensor to the Controller must be provided and must be connected to the terminal points mounted within a corrosion resistant, nonmetallic NEMA 4X enclosure. Wiring connections must be made through the bottom of the enclosure. The enclosure size must be no less than 8" wide x 5" high x 4" deep. The access door must be the entire front face panel of the enclosure. Confirm location of Controller in Field.

5. Major components must be plugged in using terminal blocks for ease of installation and replacement. Unit must be designed to activate a 24-volt AC solenoid valve.

6. Provide a make-up water solenoid valve, normally closed, stainless-steel fitted, bronze body, 24 VAC slow closing type. Size to pipe. Interlock with automatic water level control system. Refer to the Drawings for additional information.

7. Discharge of make-up water must be into a fill funnel and piping to the pool. Refer to the Drawings for additional information.

2.10 DECK EQUIPMENT, INSERTS & ANCHOR SOCKETS

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Grab rails must be provided as required in the quantities and to the dimensions as shown on the drawings. Grab rails must be fabricated of one continuous length of polished and buffed tubing. The tubing must be ASTM-A-554 grade 316L stainless-steel, 1.50-inch OD x 0.120-inch minimum wall thickness, polished and buffed to 320 grit finish and must be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance. Bends must be smooth and free of wrinkles. Grab rails must be pretzel bend style with dimensions as indicated in the plans and as manufactured by Spectrum Products, SR Smith, Paragon or approved equal. Anchor sockets for grab rails must be of the wedge type, cast bronze or stainless-steel, 4 inches in depth and made to receive 1.50-inch OD tubing as manufactured by Paragon #28105, SR Smith #AS-200B, Spectrum #54052 or approved equal. The wedge must be cast bronze, incorporate a stainless-steel tightening bolt, and flat washer, and be designed as the sacrificial element to the anchor system. Metallic components must be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance. Anchors must be provided with flush closure caps and escutcheons with set screws where indicated. Escutcheons must be of the keyhole

or oblong shape, similar to the casted, electro-polished stainless-steel escutcheon with set screw.

2. Removable ladders (2 required) must be provided as required in the quantities and to the dimensions as shown on the drawings. Ladders must be fabricated of one continuous length of polished and buffed tubing. The tubing must be ASTM-A-554 grade 316L stainless-steel, 1.50-inch OD x 0.120-inch wall thickness, and must be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance. Bends must be smooth and free of wrinkles. Rubber caps must be provided on the bottom ends of the ladder railings. Removable ladder as manufactured by Spectrum Products, Paragon, SR Smith or approved equal. Anchor sockets for ladders must be of the wedge type, cast bronze, 4 inches in depth and made to receive 1.50-inch OD tubing as manufactured by Paragon #28105, SR Smith #AS-200B, Spectrum #54052 or approved equal. The wedge must be cast bronze, incorporate a stainless-steel tightening bolt, and flat washer, and be designed as the sacrificial element to the anchor system. Metallic components must be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance. Anchors must be provided with flush closure caps and escutcheons with set screws where indicated. Escutcheons must be of the keyhole or oblong shape, similar to the casted, electro-polished stainless-steel escutcheon with set screw by Paragon #28303SS, SR Smith #IEP-200, Spectrum #24095 or approved equal.

3. Pool Lift

   a. Pool lift (1 required) must be a battery powered handicap lift with footrest assembly. Lift must comply with the Americans with Disabilities Act Access Guidelines (ADAAG), be capable of lifting 400 lbs and must include a seat belt assembly. The following accessories must also be provided: caddy, arm rest assembly, lift cover, extra battery, wired controls Stainless-steel components must be 304L. Lift must be a SR Smith Splash Aquatic Lift, #300-0000, Spectrum Products Motion Trek BP 400 #163145, Aqua Creek Products LLC Mighty 400 #F-MTY400 or approved equal. Confirm pool lift fits on pool perimeter and operates correctly.

   b. The anchor for the pool lift must be furnished with the lift. The anchor must be an embedded sleeve made of glass reinforced copolymer, 300 series stainless steel, or bronze. The depth of the anchor must be 6 inches, and the anchor must include a lug for proper bonding with the pool structure. The anchor must be installed in accordance with manufacturer's instructions, including required or recommended support footings. Manufacturer must provide an anchor cap and key for times when the lift is not in use. Sockets must be provided as stainless-steel or cast bronze for swimming pool accessories.

2.11 LOOSE EQUIPMENT

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Competition floating lane ropes must be as shown on the drawings and described in these specifications. Floating lane ropes must be a non-turbulent type with wave

quelling floats and 3/16" stainless-steel coated cable. Floats must be injection-molded polyethylene. Colors to alternate the length of the pool with a contrasting solid color for the final 15 feet (Architect/Owner to select colors). Floating lane ropes must be provided as completely assembled and installed with take up reel, type 304 stainless-steel spring and cable lock, hooks, and wrench. 5/8" wrench must be made of a forged steel shaft with a polished chrome finish. The take up reel must be constructed of type 304 stainless-steel. The spool must be a bronze nickel-plated casting with a nylon sleeve. Floating lane ropes must be similar to Competitor Swim Products, Competitor 4" Racing Lanes, Kiefer Advantage I (4.5"), or Anti-Wave ForeRunner (4.75") Racing Lanes, or Malmsten Classic Pro (4") Racing Lanes pre-assembled and sized to fit the length of the pool. Provide contrasting disks located 15 meters from each end to meet resurfacing requirement. This requirement must be met for each possible course length.

Quantities:

Lap Pool: Provide 2 at 20 yards

2.12 MAINTENANCE EQUIPMENT

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Wall brush (1 required) - Brush backing must be a flexible polyethylene material with five (5) rows of nylon bristles. Pool brush holder must be permanent mold cast aluminum with hydrofoil flap. Holder must have stainless-steel screws to facilitate brush changes. Handle bracket must be quick detachable mount to fit standard 1 ¼ or 1 ½ inch diameter handles.

2. Skimming net (1 required) - Skimmer head must consist of one-piece molded plastic frame with a reinforced, integral handle bracket suitable for quick attachment to a standard 1¼ or 1 ½ inch diameter handle using bolts and wing nut. The standard nylon net must be attached to the frame using the groove and spline method. Net depth must be 16 inches minimum in the center.

3. Telescopic Poles (x required) - Cleaning tool handle must be of the telescopic design and fabricated from corrosion resistant, high-quality anodized aluminum. Poles must be fully adjustable, to desired length, with a simple twist of a cycolac threaded locking device. Poles must consist of a 1-inch tube fitted inside a 1¼ inch tube and be adjustable from a range of 8 ft. to 16 ft. Handle must be adjustable from 8 ft. to approximately 16 ft. having a threaded bushing type clamp to lock handle at desired position.

4. Test Kits

   a. Provide two (2) test kits:

      1) The first test kit must feature liquid reagents, color comparator, waterproof instructions and treatment charts, chemistry guide and water gram. Test kit to have the ability to test for free and total chlorine (0.5 – 5.0 ppm), bromine (1-10 ppm), pH (7.0 – 8.0), acid and base demand, total alkalinity, calcium hardness and cyanuric acid.

5. The second test kit must be photometric and utilize tablet reagents for stability that will allow accurate measurement of free and total chlorine (0-10 ppm), bromine, pH, alkalinity, calcium hardness, and cyanuric acid. The test kit must have solid-state digital electronics and built-in filters. The test kit must be direct reading with automatic blank settings, automatic power cut-off, and store the last 10 results in nonvolatile memory.

6. Stainless-steel Cleaner - Provide a stainless-steel cleaner. The cleaner must comprise of one (1) gallon of organic passivation solution. It must be complete with instructions for proper maintenance of stainless-steel surfaces and material safety data sheets for the passivation solution. Product must be applied with 3M scouring pad, or equivalent.

7. Stainless-steel Protective - Provide protective coating on swimming pool rail goods. The coating must provide envelope protection. Surfaces coated must be clean and dry and free of oil, films, grease, silicones polishes and waxes, anything that leaves a film on the surface. Care must be taken not to clean the surface with a type of cleaner or solvent that may leave behind a thin film. The coating must be applied at approximately ½ mil WFT yielding a dry film thickness of 3-5 microns. Three coats are required. Allow to dry to touch between coats.

2.13 SAFETY EQUIPMENT

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Ring buoy and extension rope (1 required) – Buoy must be 24-inch diameter vinyl clad PVC foam with a metal ring molded inside. Buoy must have a 3/8-inch polyethylene rope attached to it at four points and be a minimum 60 feet in length. Preserver must be U.S.C.G. approved. Buoy and rope must be mounted at each lifeguard chair on hooks.

2. Life hook and pole (1 required) – Life hook must be an anodized aluminum 3/8-inch OD "shepherd's crook" with a 1-1/8-inch OD handle attachment suitable for a 1¼-inch 16 ft. aluminum extension pole. Hook must be of looped construction. Each pole must be provided with a set of spring type stainless-steel pole clamps for mounting on each lifeguard chair.

3. Spineboards (1 required) - Spineboard must be 72” long x 20” wide, constructed of 100% virgin high density polyethylene. The design must provide stiffness and torsional rigidity while remaining lightweight. The spineboard must accommodate up to 500 lbs and must feature customizable buoyancy that allows users to adjust the buoyancy by inserting polyethylene foam rods (supplied with the spineboard). There must be (10) handholds around the perimeter of the board. The spineboard must be supplied with one (1) 2-piece head immobilizer, one (1) head strap, four (4) body straps, one (1) head immobilizer with head bed, and two (2) flotation rods. Provide one (1) set of heavy-duty stainless-steel utility hooks per spineboard for storing the spineboard at a convenient and readily accessible location near the pool.

4. First aid kit (x required) - First aid kit must be a 24-unit kit per American Red Cross standards.

5. Rescue tube (1 required) - Provide one rescue tube for each lifeguard chair.

6. Safety eyewash station (1 required) - Safety eyewash station must be a self-contained system in which eyewash bottles are securely positioned in a portable holder. Eyewash bottles must be 32 ounces and easily removable from case, and must contain a sterile, saline solution with the ability to neutralize a varying quantity acids or caustics. Eyewash stations must be equipped with a double back screw and holes for easy mounting in location determined by the Architect.

7. Safety eyeglasses - Provided a safety eyeglass dispenser station containing ten (10) pairs of safety glasses. Eyeglasses must be ANSI/OSHA accepted.

8. Bag Valve Masks – Provide two (2) bag valve mask assistant resuscitation systems, one size Adult (1500ml tidal volume) and one size Infant/Child (450ml tidal volume). Product must be a latex free disposable bag mask unit with support strap, transparent patient valve, and textured surface to eliminate slipping. Integral swivel valve, available with a closed reservoir system. Standard pack includes resuscitator, oxygen reservoir and a transparent bag for storage.

9. AED – Provide one (1) Automated External Defibrillator and one (1) trainer AED corresponding to the chosen AED per facility level for the aquatic facility. Product location must be coordinated with the Owner and Architect. AED must be Recreonics #12-430, Lincoln Aquatics #48-013, or Defibtech Lifeline, and must have an available training AED device and associated cabinet.

2.14 THERMOMETERS

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Portable thermometer (1 required) must be a molded ABS plastic tube body type with the ability to measure temperature in both degrees Fahrenheit and Celsius. A 3 ft. polyethylene cord must be attached to thermometer.

2. Inline thermometer must be near the heating loop and must have a 9-inch adjustable angle with a minimum 6-inch stem. There must be a minimum of two (2) thermometers per loop and must have ability to read temperature in both degrees Fahrenheit and Celsius.

2.15 SWIMMING POOL FINISHES

A. Pool Tile – Reference specification section 131103, Swimming Pool Tile.

2.16 SEALANTS

A. Provide sealed joints as shown on the pool and pool structural drawings or noted on the construction joint layout, and as required. Joints must be constructed and sealed as indicated and in accordance with the manufacturer’s recommendation. Sealant must be manufactured by LATICRETE International, Inc., Mapei, or W.R. Meadows.

B. Material Storage

1. Materials must be stored in the original unopened factory containers in a cool dry location at 60 to 80 degrees F. Protect from the elements and the hazards of construction.

C. Joint Preparation

1. Clean the joints of deleterious material, to sound, clean and dry substrate.

2. If the joint is existing and part of a renovation, inspect and verify that joints have firm, solid sub-surface support up to the underside of the structural slab. Identify those joints that do not have such support and fill voids under the joint with a cement slurry (being careful not to fill the joint space itself) consisting of the following:

   a. Two (2) parts water (by weight) 10 gallons

   b. One (1) part Portland cement 47 lb. bag

   c. ¼ to ½ part bentonite ½, 50 lb. bag

3. In mixing the slurry it is recommended that the water be added first, then the cement, and finally the bentonite. The more bentonite the faster the set. Do not get the slurry on the joint itself.

4. Joint must be formed or filled with an approved, resilient, non-asphaltic, closed cell, polyethylene joint filler material down to firm substrate. Allow space at the top of the joint for the installation of approved closed cell polyethylene backer rod and install same to the required depth below the surface of the slab to control the depth of the sealant bead to within manufacturer requirements.

D. Surface Preparation

1. Concrete surfaces to receive sealant must be fully cured, clean, dry, and free of dirt, dust and deleterious material that might compromise the adhesion and performance of the sealant. Curing aids, form release agents and joint former residue must be completely removed, if necessary, by sand blasting and/or grinding. Loose dust must be brushed off.

2. Prime surfaces with appropriate and coordinated product(s) prior to sealant application in accordance with manufacturer's instructions.

E. Application

1. Apply sealant in accordance with the manufacturer's recommendations.

2. Tool the joint immediately after application to ensure a firm, intimate contact with the joint interface.

3. Remove excess sealant and smears from adjacent surfaces with a xylene or toluene solvent, before sealant cures.

2.17 POOL CONCRETE COPING

A. Precast Coping

1. The precast pool coping must be SBN/DBN style by Federal Stone (www.federalstone.com), equivalent by Dallas Cast Stone, Co. (www.dallasstone.com), or NPT precast coping (https://www.nptpool.com/hardscapes/handcrafted-stone/precast-coping/).
   Coping must have the shape and dimensions as shown on the construction drawings. Custom cast radius coping sections must be provided where required to match the pool profile. Concrete must have an equal strength and reinforcing per

Division 3 – Concrete. Coping color selections by Owner/Architect. Include manufacturers complete range of custom color options in the base bid.

2. Precast Coping Sealer

3. When recommended by coping manufacturer, coping must be sealed to reduce the possibility of staining. Refer to coping manufacturer requirements. Ensure that sealer does not create a slip-resistance issue on coping surface.

1. Precast Coping Installation & Setting Materials

   a. Surface preparation must be in accordance with ACI 302. The horizontal surface of the pool beam must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion. Sound and remove loose concrete to firm substrate. Surfaces must be roughened to a CSP of 3 to 5 (reference ICRI CSP Standards 7 to 9 for acceptable profile height). Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate must be patched per manufacturer's recommendations.

   b. Slurry Bond Coat

      1) Horizontal surface of the pool beam where coping will be set must receive a slurry bond coat. As manufactured by Laticrete International, Mapei, Inc., or Custom Building Products.

      2) The complete underside surface of each piece of pool coping must also receive a slurry bond coat. As manufactured by Laticrete International, Mapei, Inc., or Custom Building Products.

      3) Ensure bond coat is continuous and free of voids prior to application of mortar bed and setting of coping stone. Mortar bed must be set over slurry bond coat while bond coat is still moist. Refer to manufacturer recommendations for proper setting and curing procedures.

   c. Mortar & Leveling Beds

      1) Provide a dry pack, thick mortar bed on horizontal surface of pool beam for setting and leveling of coping stones. Maximum lift thickness not to exceed 2". Refer to manufacturer recommendations for proper setting and curing procedures.

   d. Coping Grout

      1) Use either Laticrete Grout, Mapei Grout or Custom Building Products Grout in accordance with the manufacturer's requirements for grout joints between coping stones. Grout products must be as manufactured by Laticrete International, Mapei, Inc., or Custom Building Products.

   e. Elastomeric Sealant

      1) Use appropriate primer and sealant for expansion/movement joints in aquatic environment. Primer and sealant installation must be in accordance with the manufacturer's requirements. As manufactured by Laticrete International, Inc., Mapei, or Custom Building Products.

      2) Provide sealed expansion joint with full depth expansion joint material and backer rod at back of coping stone where coping is adjacent to pool deck slab or other structures. Expansion joint material must be non-crosslink polyethylene foam. Ensure joint sealant is installed level with coping/deck surface and that ponding of water does not occur at joint. Sealant must be Laticrete, Mapei, or Custom Building Products sealant. Sealant color must match coping/grout color.

3) For straight runs of coping over 40 feet in length, provide an expansion joint between coping stones every 20 feet maximum. Expansion joint must be installed for the full depth of the coping stone and through the mortar setting bed. Expansion joint material must be non-crosslink polyethylene foam, trimmed to fit the void of the coping joint, and leaving a 3/8" recess at the coping surface and nosing for installation of sealant material. Sealant must be Laticrete International, Inc. Mapei, or Custom Building Products. Sealant color must match coping/grout color.

f. Mixing and application procedures must be done in accordance with the manufacturer's recommendations and requirements. The manufacturer's representative must visit the site to verify field conditions, confirm materials and application requirements and ascertain those materials and systems are installed. Documentation must be provided to this effect.

2.18 SWIMMING POOL SURFACE PADDING

A. EVA copolymer wet area surfacing system

1. Material: factory molded ethyl vinyl acetate copolymer.

2. Thickness: 3/8"

1) All necessary trim sections and transition strips must be provided as required.

2) Pattern and Color selection by Owner.

3. Performance Criteria:

a. Shock Attenuation (ASTM F1292) – 3/8" meets 1' critical fall height; 7/8" meets 4' critical fall height; 1 ¼" meets 6' critical fall height

1) Gmax: Less than 200

2) Head Injury Criteria: Less than 1000

2. Flammability (ASTM E648): Class 1

3. Toxic Characteristic Leaching Procedure (TCLP) (RCRA) by Method 3010 – Pass.

4. Comply with all manufacturer instructions and recommendations. Verify substrate conditions are suitable for installation of surfacing system. Ensure the concrete substrate is level or uniformly sloped.

5. Provide recessed slab (1/4" maximum) to accommodate the 3/8" tile depth.

6. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

7. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at a minimum temperature of 20° F and a maximum temperature of 100° F.

8. Environmental Requirements: Install surfacing system when minimum ambient temperature is 40° F and maximum ambient temperature is 90° F. Do not install in rain.

9. Concrete must conform to ACI 302 standards, be dry, fully cured (28 days), a minimum density of 100 lbs per ft3 as well as having a compressive strength greater than 4350 psi for commercial installations.

10. Measure pH of any concrete slab before installing padded floor product. The pH of the slab must be within the suggested range of the adhesive (contact adhesive manufacturer for exact range). If the pH is not within the suggested range, do not install until it fits adhesive manufacturer's requirements. Failure to do so can result in an impermanent bond.

11. The substrate must be dry, structurally sound, and dimensionally stable. It must be free of any substance or condition that may reduce or prevent the adhesive bond to substrate. This includes, but is not limited to, concrete sealers, curing agents, dirt, wax, tar, paint, and loose toppings. If the surface contains these substances, they must be mechanically removed. The use of solvents (with the exception of acetone), adhesive remover or acid etching is not recommended.

12. Concrete surface prep: Remove protrusions, bumps and ridges by grinding or chipping. Repair, fill & level cracks, holes, depressions, rough or chipped areas of substrate. Slab to have a light broom finish (hand troweled finish, or power finish. Not a burned power, troweled finish) when tile is installed.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS, INSPECTION AND PREPARATION

A. Carefully examine of the contract documents for requirements that affect the work of this section. Prior to starting work, notify the General Contractor of defects requiring correction. Do not start work until conditions are satisfactory.

B. Verify that work by others, related to this section, has been completed. This includes earthwork, concrete work, and mechanical, electrical, and plumbing connections.

C. Protect materials and work completed by others from damage while completing the work in this section.

3.02 FIELD MEASUREMENTS

A. If field measurements differ from the construction drawing dimensions, notification must be given to the Architect prior to proceeding with work.

3.03 EXCAVATION, REINFORCING STEEL AND SWIMMING POOL CAST-IN-PLACE CONCRETE

A. Reference Division 3 - Concrete

3.04 TOLERANCES FOR CONSTRUCTION OF THE POOL SHELL

A. The completed structures must be constructed level and to the dimensions, elevation, depths, and thickness as shown on the plans.

B. The elevation tolerance of the pool shell and gutter lip must be plus or minus 1/8 inch.

C. The vertical wall surface tolerance of the pool shell, for the first 36 inches from the water surface must be plus or minus 1/4 inch from plumb measured with a 6-foot straight edge.

D. Ground wires or grade pins, if used, must be installed in such a manner that they accurately outline the section of the pool shell as indicated on the plans. They must be located at intervals sufficient to ensure proper thickness throughout and must be maintained tight. Grade pins or grounding wires must not be permanently embedded in the pool shell.

3.05 WATER TIGHTNESS TEST

A. The water tightness test described within the following section is in accordance with the Hydrostatic Tightness Testing of an Open Concrete Containment Structure as required by American Concrete Institute (ACI) 350.1-10 Section 2. Test reports must be provided and must include test locations within the structure, dates of testing, water level measurements, amounts of evaporation or precipitation, measured volume corrections, retest results (if applicable), actions taken, and final results.

B. Water Tightness Test Procedure

1. Preparation

a. For concrete pools: Allow the concrete structure to set 28 days for curing purposes. Once the shell has gained sufficient strength to withstand the test load and after the outlets have been securely sealed, the pool must be filled with water.

2. Fill: Fill and then isolate the pool. The water tightness test must begin after the vessel has been filled for a minimum of three (3) days. During the filling, outlets must be monitored for water tightness and concrete joints, if applicable, must be monitored for visible leakage. If visible leakage from the vessel is observed, the condition must be corrected prior to the start of the test.

a. After the initial fill, ground water must be removed from the pool sight sump or the pool location de-watering system. This must be completed prior to the start of the water tightness test. De-watering of the pool sight sump must be maintained during the entire duration of the test.

3. 24-hour Allowable Loss

a. Calculate the allowable water loss from the unlined vessel(s). This is .1% of the total vessel volume. For the example, the vessel has a volume of 200,000 gallons, the 24-hour allowable loss will be 200 gallons.

Vessel	Total Volume (Gallons)	24-hour Allowable loss (.1% or .001 of Total Volume)
EXAMPLE	200,000 gal	200 gal
Pool 1		

4. Measurement

a. Measurements must be taken at the pool and the gutter system(s). Multiple test points with averaging are recommended for vessels which will be exposed to wind. Document the separate findings on the chart below. Repeat the measurements and document every 12 hours for a total of three (3) days. The General Contractor must check the pool for water loss with the Architect or Owner's representative every 12 hours. Submit photo documentation of each measurement with the completed water tightness report. Example measurements are shown in the table below.

5. Evaporation Measurement Procedure

a. Fill a floating, restrained, partially filled, calibrated, open pan with water and allow the container to float within the pool during the testing period. This will be used to measure evaporation.

Vessel	12 hrs. passed	24 hrs. passed	Day 1 TOTAL	36 hrs. passed	48 hrs. passed	Day 2 TOTAL	60 hrs. passed	72 hrs. passed	Day 3 TOTAL
Example Pool	.021 ft	.010 ft	.031 ft	.016 ft	.019 ft	.035 ft	.012 ft	.017 ft	.039 ft
Example Pan	.008 ft	.006 ft	.014 ft	.008 ft	.007 ft	.015 ft	.009 ft	.007 ft	.016 ft
Pool 1									

6. Calculate Daily Loss

a. Calculate the total daily water loss for the vessel(s) and record in the table below. If a vessel has a daily water loss that is greater than the calculated 24-hour allowable loss, the vessel cannot be considered watertight.

3) Daily Loss = 7.481 x Structure Surface Area (SF) x [Total Water Loss per Day (FT) – Evaporation per Day (FT) + Precipitation per Day (FT)]

b. For the example, we have a body of water that is 200,000-gallon volume and 3,500 square feet of surface area. Measurements for this example body of water are recorded in the table above.

1) Day 1 Loss = (7.481 gallons per cubic foot) x (3,500 SF) X [(.031 ft water loss) – (.014 ft evaporation) + (0 ft precipitation)] = 445 gallons Day 1 loss

2) Day 2 Loss = (7.481 gallons per cubic foot) x (3,500 SF) X [(.035 ft water loss) – (.015 ft evaporation) + (0 ft precipitation)] = 524 gallons Day 2 loss

3) Day 3 Loss = (7.481 gallons per cubic foot) x (3,500 SF) X [(.039 ft water loss) – (.016 ft evaporation) + (0 ft precipitation)] = 602 gallons Day 3 loss

Vessel	Daily Water Loss Day 1 (Gal)	Daily Water Loss Day 2 (Gal)	Daily Water Loss Day 3 (Gal)	Allowable Loss (calculated above, Gal)	Are daily values higher than the Allowable Loss? (Y/N)
EXAMPLE	445 gal	524 gal	602 gal	200 gal	Y, not watertight
Pool 1					

7. Absorption

a. Waiting 3 days after the initial water fill will allow the concrete to absorb water and must be sufficient to minimize the effect of absorption on the test results.

8. Evaporation

a. Evaporation must not have a significant effect on natatoria that are completely enclosed with no air circulation during the water tightness test. However, evaporation will have a significant effect on the water level in

natatoria that has air movement across the water surface or are still partially uncovered.

9. If leaks are detected, repair the vessel, and make watertight in accordance with these requirements.

10. With regard to this test, the curing requirements, the final fill, and the cost of the water for two (2) complete fillings must be borne by the Owner. Expenses for subsequent fillings or partial fillings (more than 25%) of the pool must be provided and will not be borne by the Owner.

3.06 PIPING INSTALLATION

A. General

1. Provide and erect, according to the best practices of the trade, piping shown on the drawings and required for the complete installation of these systems. The piping shown on the drawings must be considered as diagrammatic in indicating the general run and connections and may or may not in parts be shown in its true position. The piping may have to offset, lowered, or raised as required or as directed at the site. This does not relieve responsibility for the proper erection of the systems or piping in every respect suitable for the work intended as described in the specifications and approved by the Architect. In the erection of piping, it must be properly supported, and proper provisions must be made for expansion, contraction and anchoring of piping. Piping must be cut accurately for fabrication to measurements established at the construction site. Pipe must be worked into place without springing and/or forcing, properly clearing windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted. Pipes must have burrs and/or cutting slag removed by reaming or other cleaning methods in strict accordance with the manufacturer's instructions. Changes in direction must be made with fittings. Open ends of pipes and equipment must be properly capped or plugged to keep dirt and other foreign materials out of the systems. Plugs of rags, wool, cotton waste or similar materials will not be used in plugging. Piping must be arranged so as not to interfere with removal and maintenance of equipment, filters, or devices, and so as not to block access to manholes, access openings, etc. Flanges or unions as applicable for the type of piping specified must be provided in the piping at connections to items of equipment. Piping must be installed to ensure noiseless circulation. Valves and specialties must be so placed to permit easy operation and access.

B. Pipe Hangers and Supports

1. Pipes must be adequately supported by pipe hangers and supports specified in Paragraph 2.05 Pipe, Hangers, and Valves.

2. Horizontal PVC Schedule 80 piping must be supported in accordance with the manufacturer’s recommendations for fluid temperature not exceeding 120-degree F and as listed below:

Nominal Pipe Size (Inch)	Hanger Support Spacing (Feet)	Minimum Rod Size for Single Rod Hanger

		(Inch)
1-1/4” and less	5	3/8”
1-1/2” to 3”	6	1/2”
4” to 6”	8	5/8”
8” to 12”	10	7/8”
Greater than 12”	12	1”

3. Horizontal CPVC Schedule 80 piping must be supported in accordance with the manufacturer’s recommendations for fluid temperature not exceeding 140-degree F and as listed below:

Nominal Pipe Size (Inch)	Hanger Support Spacing (Feet)	Minimum Rod Size for Single Rod Hanger (Inch)
½” and less *	4	3/8”
¾” to 2”	6	3/8”
2-1/2” to 3”	7	1/2”
4” to 8”	8	7/8”
Greater than 12”	10	1”

C. Provide means of preventing dissimilar metal contact such as plastic-coated hangers, copper colored epoxy paint, or non adhesive isolation tape.

D. Provide hangers to provide a minimum of 1-inch space between finished covering and adjacent work.

E. Place a hanger within 12 inches of each horizontal elbow.

F. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.

G. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified in section 2.05.C.3. Trapeze hangers must be spaced according to the smallest pipe size or provide intermediate supports according to the support spacing schedules.

H. Do not support piping from other pipes, ductwork or other equipment that is not building structure. Do not modify building structure for hanger installation.

I. Concrete Inserts

1. Provide inserts for placement in form work before concrete is poured.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Where concrete slabs form finished ceilings, provide inserts must be flush with the slab surface.
4. Provide hook rods to concrete reinforcement section for inserts carrying pipe over 4 inches.

J. Pipe Hangers and Supports

1. Piping must be rigidly supported from the building structure by means of hanger assemblies properly selected and sized for the application in accordance with the manufacturer's recommendations and specifications.

2. A design for piping in a service tunnel, if required, supported by a structure must be submitted for approval. The structure must be non-corrodible and must be of a size and configuration to rigidly support the piping as shown in the plans at a minimum spacing as shown below.

3. Piping hangers must be spaced per the below schedule and must have hangers not more than one foot on each side of every change in direction. The piping systems must be installed in an approved manner and must not overload the building structural frame. Provide additional hangers and miscellaneous steel supports as required to distribute the piping system load over several structural members where required or directed. Maximum allowable spacing for piping must be as follows:

PVC Piping	Maximum Spacing
3/4" thru 2"	5'-0"
2 1/2" thru 4”	6'-0"
6" thru 10"	9'-0"
12” thru 14"	12’-0”

4. Round rods supporting the pipe hangers must be of the following dimensions:

1/2" to 2" pipe	-3/8" rod
2-1/2" to 3" pipe	-1/2" rod
4" to 5" pipe	-5/8" rod
6" pipe	-3/4" rod

5. Hanger rods must be galvanized steel. Provide for controlling level and slope by turn buckles or other approved means of adjustment and incorporate lock nuts.

6. Where piping is installed side by side, support the piping by utilizing trapeze type hanger assemblies. Horizontal trapeze member must be non-metallic channel. Provide heavier members as required for the load supported for the entire span distance. Hanger rods must be as specified above and properly sized for the load supported, but not less than 5/8 inches diameter.

7. The use of pipe hooks, chains, or perforated iron for pipe hanger supports will not be permitted.

8. Attachment of piping hangers to the building structure must be provided in a manner approved by the Architect. Provide concrete inserts installed by the General Contractor in the building construction at the time the concrete is poured, and hangers must be attached to these inserts.

K. Piping Installation – Below Grade

1. Trench bottoms must be smooth and free of rocks and debris. If the trench is dug in ledge rock, hardpan or where large boulders are not removed, place 3 inches of sand or compacted fine-grained soil below pipe. Pipe must be supported over its entire length with firm, stable material. Blocking will not be used to change pipe grade or provide intermittent support over low sections in the trench. Surround the pipe with backfill meeting the requirements of Section 02200/312000 with a particle size of 1-

1/2 inch or less and in accordance with the project geotechnical report. Compact in layers not to exceed 6 inches with vibratory method. Follow installation methods of ASTM D2774 "Underground Installation of Thermoplastic Pressure Piping".

L. Flushing, Draining and Cleaning Pipe Systems

1. Flush out water systems with water before placing them in operation. Other systems must be cleaned by using compressed air or nitrogen. After systems are in operation and during the test period, strainer screens must be removed and thoroughly cleaned.

M. Expansion and Contraction

1. Make necessary provisions for expansion and contraction of piping with offsets, loops, flexible connections, and anchors as required to prevent undue strain. Provide shop drawings for method and arrangement for control of expansion and contraction of piping.

N. Testing

1. Piping installation and pressure testing must be reviewed by the Owner’s testing agency before commencement of backfilling. A minimum notice of one (1) week is required prior to review. Results of review must be documented.

2. Pool related piping must be hydraulically pressure tested (with water, not air) to a pressure of not less than 50 PSI for a period of no less than two (2) hours.

3. Maintain a sustained 20 PSI pressure on pool related piping throughout the course of construction.

4. Adhere to the applicable provisions of Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.

3.07 EQUIPMENT AND SYSTEMS INSTALLATION

A. Provide and assemble equipment, special parts and accessories as shown on pool drawings, specifications, and shop drawings of the equipment suppliers.

B. Provide anchors and inserts imbedded in the deck including fittings, inserts and structure sleeves and required anchorage as shown on the plans and as indicated in this section of the specifications. Equipment must be set true and plumb, using factory jigs where available. Removable equipment items must be easily removable from anchors and must fit without noticeable wobble.

C. Provide templates for equipment anchors. Provide anchor bolts of the size and spacing as required by the equipment manufacturer. Anchor bolts must be stainless-steel Type 316L and of a length capable of adequate anchorage into rough slab-on-grade allowing for finish deck tile and setting bed. Anchors must be set and cast into place during building concrete work. Inspect anchor settings for horizontal and vertical alignment prior to placing concrete.

D. Provide equipment and systems in accordance with manufacturer's directions. Equipment must be assembled and in place for final observation.

E. Items necessary to complete this section are shown on the plans or described in the specifications including items that may be purchased by the Owner. Items are detailed and specified as a guide for dimensional purposes. Make provisions accordingly and submit shop drawings and submittals based on that data.

3.08 START-UP AND INSTRUCTION

A. Supply the services of an experienced swimming pool operator/instructor for a period of not less than two days (total 16 hours) after the `pool have been filled and initially placed in operation. During this period, the Owner's representatives who will be operating the `pool must be thoroughly instructed in phases of the pool's operation. Deliver six (6) complete sets of operating and maintenance instructions for the swimming pool, structures, finishes and component equipment. Prior to leaving the job, obtain written certification from the designated Owner's representative acknowledging that the instruction period has been completed and necessary operating information provided. Include the cost of two (2) additional days (total 16 hours) of instruction and operational check out by the qualified representative during the first season of operation.

B. Written reports of each of these visits outlining the pool's operation, competence and performance of the pool's operation personnel, and other pertinent comments must be submitted to the Owner and Architect/Engineer within one (1) week after each visit.

C. Provide specific written procedures that must be followed for emptying and refilling the pool as mentioned previously in this section. The procedures must be included in the bound volume of operating instructions and references in the front index with a note headed by the words: "CAUTION -- VERY IMPORTANT".

END OF SECTION 131100

SECTION 131103 - SWIMMING POOL TILE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and General Provisions of the contract, including General and Supplementary Conditions apply to work of this section.

1.02 SUMMARY

A. Provide a ceramic tile finish on the entire interior surface of the pool and behind the pool edge as shown and detailed on the contract drawings and in strict accordance with these specifications. The cementitious pool finish must have ceramic tile markings and trim at locations including the pool perimeter tile band, vertical tile band, stairs, nosings, the zero entry, recessed wall steps, depth markings, wall targets, floor lane markings and other tile installations as shown and detailed on the contract drawings and in strict accordance with these specifications.

B. Provide a ceramic tile finish on the entire interior surface of the spa.

C. The CONTRACTOR must furnish and install the work of this section.

1.03 RELATED SECTIONS

A. Division 1 – Mock Ups

B. Division 7 - Joint Sealers

C. Division 9 - Ceramic Tile

D. Section 13150/131100 - Swimming Pool

E. Section 131104 - Swimming Pool Cementitious Finish

1.04 QUALITY ASSURANCE

A. Reference Standards: Conform to the following standards unless otherwise required herein.

1. American National Standards Institute (ANSI)

a. A108.01 – General Requirements: Subsurfaces and Preparations by Other Trades.

b. A108.02 – General Requirements: Materials, Environmental, and Workmanship.

c. A108.1, Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile and Paver Tile installed with Portland Cement Mortar.

d. A108.1C – Contractor’s Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile

on a Cured Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry Set or Latex-Portland Cement Mortar.

e. A108.5 – Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.

f. A108.6 – Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy for the Epoxy Grouting Installation Process.

g. A108.10 – Installation of Grout in Tile Work.

h. A137.1 Standard Specifications for Ceramic Tile.

2. American Society for Testing and Materials (ASTM)

a. C144-99, Aggregate for Masonry Mortar

b. C150-00, Portland Cement

c. C171-97a, Sheet Materials for Curing Concrete

d. C206-97, Finishing Hydrated Lime

e. C207-91 (R1997), Hydrated Lime for Masonry Purposes

f. D5957, Standard Guide for Flood Testing Horizontal Waterproofing Installations

g. F-1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

h. F-2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes

3. Tile Council of North America (TCNA); 2021 Edition, Handbook for Ceramic Tile Installation.

4. International Standards Organization (ISO) (NOTE TO SPECIFIER: Include this section for all international projects.)

a. ISO 13007 – Part 1: 2004 Ceramic Tiles – Grouts and adhesives; specifies the value of performance requirements for tile adhesives.

b. ISO 13007 – Part 2: 2005 Ceramic Tiles – Grouts and adhesives; test method for adhesives.

c. ISO 13007 – Part 3: 2005 Ceramic Tiles – Grouts and adhesives; terms, definitions and specifications for grout.

d. ISO 13007 – Part 4: 2005 Ceramic Tiles – Test methods for grout.

5. American Concrete Institute

a. ACI 302 – Guide for Concrete and Floor Slab Construction

6. International Concrete Repair Institute (ICRI)

a. Concrete Surface Profile (CSP)

B. Tile installers must have two years' experience in similar pool projects which the Owner may require written proof thereof and proper tools to install tile.

1.05 MANUFACTURERS

A. Subject to compliance with requirements provide ceramic tile, mortar and grout of the following manufacturers: American Olean Tile Co. (tile), Dal-Tile Co. (tile), Buchtal (tile), KlinkerSire (tile), Daldorado (tile), MAPEI, Inc. (thin-set, waterproofing, grout and admixtures), and LATICRETE International Inc. (thin-set, waterproofing, grout and admixtures) or approved equal.

1.06 SUBMITTALS

A. Submit shop drawings indicating tile layout, patterns, joint layout, color arrangement, perimeter conditions, junctions with dissimilar materials, thresholds and setting details.

B. Submit product data indicating material specifications, characteristics, and instructions for using adhesives and grouts.

C. Samples:

1. Mount tile and apply grout on 24”x24” backerboard to indicate pattern, color variation and grout joint size variations of each pattern. Furnish mounted tile samples as requested by the architect/owner.

D. Submit manufacturer's installation instruction.

E. Submit maintenance data.

1. Include recommended cleaning and stain removal methods, cleaning materials.

1.07 PRODUCT DELIVERY AND STORAGE

A. Deliver tile materials to site in unopened factory containers sealed with grade seals bearing printed name or manufacturer and the words "Standard Grade". Keep the grade seals intact and containers dry until tiles are used. Keep cementitious materials dry until used.

1.08 JOB CONDITIONS

A. Inspect and verify job conditions. Report defects in base surfaces for correction before proceeding.

B. Maintain environmental conditions, including temperature humidity and ventilation, within limits recommended by the manufacturer. Do not install products under environmental conditions outside manufacturer’s absolute limits.

C. Do not install mortar, set, or grout tile exterior when inclement weather conditions are expected within 48 hours after work is scheduled to be completed unless proper protection is provided.

D. Maintain a temperature range of 50 degrees Fahrenheit to 90 degrees Fahrenheit during installation of tile and grout materials. Tile installation should cure for a minimum 14 days with average a temperature of 70 degrees, while maintaining the minimum 40 degrees and maximum 90 degrees Fahrenheit, prior to filling pool with water.

E. Vent temporary heaters to outside to avoid carbon dioxide damage to the new tile work.

1.09 COLORS

A. Colors must be selected by the Architect or Interior Designer. Note that swimming pool regulations may dictate color selections within the pool tank. See tile materials for price group breakdowns.

1.10 WARRANTIES

A. The CONTRACTOR warrants to the Owner that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted and that the work will conform with 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 warranty excludes remedy for damage or defect caused by abuse, improper or insufficient maintenance, improper operation, modifications not executed by the CONTRACTOR or improper wear and tear under normal usage. If required by the Owner, provide satisfactory evidence as to the kind and quality of materials and equipment. Warranties must be for a period of five years, unless otherwise specified.

B. Setting materials must be provided by the same manufacturer. Mixing materials and application procedures must be done in accordance with manufacturer's recommendations and requirements. Documentation must be provided to this affect by the contractor with verification from the manufacturer. This documentation must be included in the operations and maintenance manual under warranties as documentation qualifying the project for a 15 Year Systems Warranty by LATICRETE International, Inc., MAPEI, Inc. or approved equal.

C. Contractor must contact the tile setting material manufacturer's technical representative to review installation details, job site conditions, selected materials and their conformance to the manufacturer's warranty requirements prior to the commencement of work. Failure to follow these requirements will not relieve the Contractor of the requirement to provide specified warranties.

D. Contractor must agree to repair or replace work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.

PART 2 - PRODUCTS

2.01 TILE MATERIALS

A. Standard grade conforming to ANSI A137.1. Provide trimmer units as indicated and specified, including special shapes as detailed or required. Tile patterns and colors must be as indicated and specified, colors of approved shades. Mesh mounted or perforated paper backed tile is not allowed where the mesh of paper remains as a permanent part of the installation. If dot mounting is used, a minimum of 67% of the depth of the tile must be free from dots to ensure proper grout curing.

B. Tile must be “frost-proof” and suited for an outdoor pool installation in a freeze/thaw climate.

C. Unglazed Ceramic Mosaic Tile

1. Slip-resistant porcelain unglazed ceramic mosaic tile, cushion or all-purpose edges, 2” square from price group 2 for floor, walls, and stair treads unless otherwise noted. Minimum dynamic coefficient of friction must be 0.42 for wet surfaces and 0.65 for ramped surfaces. Where special shapes are required, they must be selected from price group 3. Equivalents provided by Knoxtile, Dal-Tile or American Olean. For wet surfaces: Buchtal Chroma Mosaics with front mount film (seven color options) 2”x2” 7161HVF or American Olean Unglazed color-body porcelain mosaics 2”x2”, price group 1-3. For ramps: Buchtal Chroma non-slip mosaics with glass fiber net (four color options) 2”x2” 7161H. Or for wet surfaces or ramps: Buchtal Chroma non-slip 5”x5” 32020H thirteen color options) or Dal-Tile or American Olean Unglazed color-body mosaics 2”x2” with 7.5% abrasive grain (7 color options). Colors must be selected by the architect.

2. Ceramic tile band below the pool gutter lip, crown detail at stairs, and recessed steps with color selected by Architect from Dal-Tile, Keystone Unglazed Mosaic, 2”x2” price group 4, American Olean Unglazed color-body porcelain mosaics 2”x2” price group 1-3, or powder glazed 2”x2” Buchtal Chroma Mosaics provided by Knoxtile.

3. Ceramic tile deck band that contains the depth marker letters and numerals and the 15-meter resurfacing markers with color selected by the Architect from Dal-Tile, Keystone Unglazed Mosaic, 2”x2”, price group 4, American Olean Unglazed color-body porcelain mosaics 2”x2”, price group 1-3.

4. Contrasting ceramic tile nosings at pool stairs, recessed steps, underwater bench, underwater shelf, spa steps and spa bench must be Universal Trim 2”x2” with color selected by the Architect from Dal-Tile, Keystone Unglazed Mosaic, price group 3 and 4, American Olean Unglazed color-body porcelain mosaics 2”x2”, price group 1-3, or Safety Edge Tile from Inlays, Inc.; Black CPC00022, Blue CPC00021, Brown CPC00023 and Green CPC00024 (NOTE TO SPECIFIER: SAFETY EDGE TILE MUST BE USED FOR POOLS THAT ARE REQUIRED TO BE MAHC COMPLIANT. DELETE ALL OTHER OPTIONS).

5. Recessed steps must be Universal Trim 2”x2” or 1”x1” with color selected by the Architect from Dal-Tile, Keystone Unglazed Mosaic, price group 3 and 4, American Olean Unglazed color-body porcelain mosaics 2”x2”, price group 1-3.

6. 4” wide contrasting ceramic tile stripe and 12” lane markers on the pool floor with color selected by Architect from Dal-Tile, Keystone Unglazed Mosaic, 2”x2” price group 3, American Olean Unglazed color-body porcelain mosaics 2”x2” price group 3, or from Knoxtile, as 4”x4” Buchtal Chroma Colors 22010H-717, 5556 Grey Black and 5535 Blue or 2”x2” Mosaic 7160HVF 5535 Grey Black. The main racecourse wall targets and lane markers must be black. The cross-course wall targets and lane markers must be midnight blue.

D. Provide tile trim units where indicated or necessary for a complete and finished installation. Provide rounded units for external and internal corners and angles. Provide trim units of material and finish identical to the adjoining tile. Provide SCR/L701 units where the C701 hand hold is interrupted to permit draining. Contractor should request via non-standard

production. The SCR/L701 units are available through DalTile at 314-997-6970 or 1-800-672-2086.

E. Message Tile and Depth Markings

1. Deck messages must be provided in 1”x1” unglazed ceramic tile using “special” characters minimum 5” high as described in American Olean "Ceramic Tile for Swimming Pools" booklet 805 or by Inlays, Inc. Provide 4/5” high vertical depth markers on the wall just above/below the water line. Provide waterjet cut solid tile piece, set in a field of 2”x2” tiles as described in Inlays, Inc. catalog “Mosaic Pool Markers”. Message tile must contrast with the field tile. Refer to Architect for color selections.

2. Horizontal and vertical depth markings and warning signs must be 6”x6” with 4” high numbers and letters. Horizontal depth markers must be slip resistant. Single tile abbreviations must be used for ‘FT’ and ‘IN’. Tile markings must be used for ‘FEET’ and ‘INCHES’.

2.02 Swimming Pool Setting Materials and Installation

F. Surface Preparation

1. Surface preparation must be in accordance with ACI 302. The surface must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion. Sound and remove loose concrete to firm substrate. Surfaces must be roughened to a CSP of 3 to 5 (reference ICRI CSP Standards for acceptable profile height). Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate must be patched per manufacturer’s recommendations.

G. Slurry Bond Coat

1. Thick bed mortar application must be installed over a slurry bond coat of either LATICRETE 254 Platinum one-step, polymer-fortified, thin-set mortar or MAPEI Planislope RS polymer-modified pre-blended, rapid-setting mortar mixed with water only in compliance with ANSI A108.1A (2.2 & 5.2). As manufactured by LATICRETE International, MAPEI, Inc., or approved equal. Note that slurry bond coats are not required under vertical applications of the render and scratch coat.

H. Mortar & Leveling Beds

1. Bonded Thick Bed Method (Floor / Horizontal Surfaces): Provide a dry pack, thick mortar bed on horizontal surfaces consisting of LATICRETE 3701 Fortified Mortar Bed or MAPEI Planislope RS polymer-modified pre-blended, rapid-setting mortar mixed with water only. Apply over a properly prepared slurry bond coat. Maximum lift thickness not to exceed 2”.

2. Render- Scratch and Float Coats (Wall / Vertical Surfaces): Provide wall render (scratch and float coats) on vertical competition turning surfaces to a depth of 4’-0” below the water surface, consisting of either LATICRETE 3701 Fortified Mortar Bed or MAPEI Planislope RS polymer-modified pre-blended, rapid-setting mortar mixed with water only for lift thicknesses up to ½”. Wall render is made to a plastic consistency when used vertically. Fill holes and bring surface up to line and plane as required. As manufactured by LATICRETE International, MAPEI, Inc. or approved

equal. Note that slurry bond coats are not required under vertical applications of the render and scratch coat.

I. Tile Thin-Set

1. Use either LATICRETE 254 Platinum one-step, polymer fortified, thin-set mortar or MAPEI Keraflex Super one-step, polymer modified, thin-set mortar, used in accordance with the manufacturer's requirements. As manufactured by LATICRETE International, MAPEI, Inc., or approved equal.

J. Tile Grout

2. Use either LATICRETE SPECTRALOCK PRO Premium Grout or MAPEI Kerapoxy CQ Grout in accordance with the manufacturer's requirements as manufactured by LATICRETE International, MAPEI, Inc. or approved equal.

K. Elastomeric Sealant

1. Use LATICRETE LATASIL over LATASIL 9118 primer or MAPEI Mapesil "T" 100% silicone sealant for inside/outside corners, expansion/movement joints, and to seal lighting/plumbing fixture penetrations. Primer and sealant installation must be in accordance with the manufacturer's requirements. As manufactured by LATICRETE International, Inc., MAPEI, Inc. or approved equal.

L. Mixing and application procedures must be in accordance with the manufacturer's recommendations and requirements. The manufacturer's representative must visit the site to verify field conditions, confirm materials and application requirements and ascertain that PART 3 - EXECUTION

3.01 PREPARATION

A. Complete water tightness test prior to tile installation. Concrete tank must be watertight per ASTM D5957, the Tile Council of North America, and specification 13150/131100.

B. Clean substrates of dust, dirt, oil, grease and deleterious substances and mechanically roughen concrete and shotcrete for bond. Conform to applicable reference standards and to recommendations of manufacturers of materials used and meeting ICRI, CSP of 2-3 (NOTE TO SPECIFIER: For use with waterproof membranes) 3-5 (NOTE TO SPECIFIER: For use without waterproof membranes).

C. Substrates to Receive Mortar Setting Beds

1. Dampen concrete substrate to receive tile work according to above referenced standards or tile manufacturer's instructions, as required.

D. Substrates to receive thin set tile applications must meet normal construction tolerances of 1/4" in 10' where competition tolerances do not apply and must meet competition tolerances where required elsewhere in these specifications, and must be free of bumps, dips and surface irregularities that may effect the satisfactory installation of the tile.

E. Tile Wetting

1. Dampen tile according to above reference standards or tile manufacturer's instructions, as required.

F. Screeds

1. Accurately set temporary screeds to control the finish plane of mortar-bed set tile and remove as soon as setting bed is sufficiently hardened. Fill void spaces from screeds with same mortar.

3.02 TILE INSTALLATION

A. Arrange tile according to patterns detailed. Set tile with flush well-fitted joints, finished in true planes, plumb, square, joints of uniform size. Provide approved trimmers as shown or required. Cut tile without marring. Carefully grind and joint tile edges and cuts.

B. Follow Tile Council of North America installation methods P601 and B417 to achieve total tile system thickness for thin or thick-set.

1. Thick Set

a. Apply specified setting bed mortar, up to 2” in thickness, on cured and dried concrete pool shell. Tamp and screed to required planes. Spread no more mortar than can be covered with tile before initial set. Do not use re-tempered mortar. Trowel 3/32” to 1/8” thick bond coat over plastic setting bed mortar just before setting tile or apply bond coat to back of each tile placed. 95% coverage of the back of the tile or tile sheet is required. Set tile in position and beat firmly into the setting bed mortar. Bring tile faces to a true and correct plane. Complete beating and leveling before mortar sets and in no case later than one hour after first placing. When ready, wet and remove paper and glue avoiding excess water. At this time adjust out-of-line or out-of-level tile.

2. Thin Set

a. Apply specified bond coat on cured and dried concrete pool shell. Trowel 3/32” to 1/8” thick bond coat over concrete pool shell just before setting tile or apply bond coat to back of each tile placed. 95% coverage of the back of the tile or tile sheet is required. Set tile in position and beat firmly into the setting bed mortar. Bring tile faces to a true and correct plane. Complete beating and leveling before mortar sets and in no case later than one hour after first placing. When ready, wet and remove paper and glue avoiding excess water. At this time adjust out-of-line or out-of-level tile.

C. Finished tile surface must be level and in plane, with no sharp or protruding edges. Tiles out or plane more then 1/16" must be removed and replaced. Sharp edges must be stoned smooth.

D. Grout Joint Sizes

1. Unless otherwise approved, install tile with uniform 3/32” joint width. A maximum 1/8" joint width may be utilized to meet specific installation requirements, if required.

E. Ceramic Tile Joint Grouting

1. Mix grout to a thick creamy consistency and force into joints for entire thick depth, flush with surface. Clean off excess and fill skips and gaps before grout sets. Color

selection by Architect or Interior Designer. Provide dampness for minimum 3-day curing and polish with clean dry cloths (not required when epoxy grouts are used).

F. Expansion Joints

1. Place expansion joint per applicable TCNA Method P601MB, P601TB, or P602 and conforming to Method EJ171. Provide shop drawings showing backer rod and joint dimensions. Expansion, control, construction, cold, and seismic joints in the pool structure should continue through the tile work, including such joints at vertical surfaces. Movement joints must be placed at changes in direction and elevation. Refer to the structural engineer for additional required movement joints. Joint size must be a minimum of 1/8". Joints through tile work directly over structural joints must not be narrower than the structural joint. The Contractor must use cement compatible coatings when using chalk lines for joint layout purposes.

G. Fill and Empty Rates

1. Use a fill and drain rate of 2'-0" per 24 hours to minimize thermal shock and structural movement. Maintain a temperature differential of 10 degrees Fahrenheit or less between the pool water and the substrate during fill and drain cycles.

3.03 TESTING AND INSPECTION

A. Before filling of the pool, and its subsequent provisional acceptance at substantial completion, the tile installation must be visually inspected and sounded in the presence of the Architects and/or the Owner's representative to verify mortar coverage below the tile to its substrate as well as its overall compliance with the requirements of this Section.

B. Tile work found loose, lacking proper mortar coverage, out of plane, misaligned or otherwise non-conforming must be removed and replaced at no additional cost to the Owner.

3.04 CLEANING

A. Upon completion of placement and grouting, clean tile installation as recommended by TCNA and manufacturers of proprietary materials. Tile must be cleaned with pH neutral solutions, free of both sodium and potassium, in accordance with the tile and grout manufacturer's printed instruction.

B. Leave finished installation clean and free of cracked, chipped, broken, un-bonded or otherwise defective tile work.

C. Protect installed tile work with non-staining Kraft paper, polyethylene sheeting, or other approved heavy covering during the construction period to prevent damage.

3.05 REPLACEMENT TILE

A. Provide Owner with approximately 10% or 25 square feet (whichever is least) of each color and type tile used on the project for Owner's repair and replacement requirements.

END OF SECTION 131103

SECTION 131105 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Demolition and removal of selected pool materials and equipment.
2. Salvage of existing items to be reused or recycled.
3. Protection of surrounding areas.

B. Related Requirements:

1. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.

C. Related work specified in other sections:

1. Section 13150/131100 - Swimming Pools
2. Section 13154/131103 – Swimming Pool Tile

1.03 DEFINITIONS

A. Remove: Detach and remove items from the pool and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Store: Detach and store existing swimming pool items intended for reinstallation and/or reuse.

1.04 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.05 SUBMITTALS

A. Proposed Protection Measures: Submit plan and report that indicates the measures proposed for protecting individuals and property for dust control and for noise control. Double containment and dedicated exhaust required. Indicate proposed locations and construction of barriers.

1.06 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.07 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

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owners Representative.

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.

PART 2 - PRODUCTS

2.01 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 OSHA Standards 29 CFR Part 1926 & 1910.

C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Review record documents of existing construction provided by Owners Representative. Owners Representative does not guarantee that existing conditions are same as those indicated in record documents.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. 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.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

E. Notify owner on completion of selective demolition, and obtain documentation verifying that existing surfaces have been inspected and accepted.

3.02 PREPARATION

F. 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.

G. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Contractor to provide a dust control plan for review by the Owner's Representative.
2. Primary removal of pool tile and mortar must be performed by hydro-blast process. Sand blasting will not be permitted.
3. Double containment with dedicated exhaust of work area and pathway of removal is required.
4. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
5. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
6. Cover and protect furniture, furnishings, and equipment that have not been removed.
7. Comply with requirements for temporary enclosures and dust control.

3.03 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing pool finishes as described and/or indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Swimming pool recirculation pump, filter, piping, gutter, main drain to be demolished and removed.
2. Proceed with selective demolition of the pool ceramic tile including the tenting or covering of work areas during this process. Comply with guidelines outlined in the Performance Requirements of this specification.
3. Remove and dispose of piping encased in the pool wall, existing pool fittings, and equipment as identified on the demolition drawings.
4. Dispose of demolished items and materials promptly.

3.04 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 in an EPA-approved landfill.

1. Protect all finished surfaces during the demolition process.

2. Do not allow demolished materials to accumulate on-site.

3. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.05 CLEANING

A. Clean adjacent structures and improvements including but not limited to structural spaces of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 131105

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Wall Penetration Systems.
7. Escutcheons.
8. Grout.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.

2. CPVC: Chlorinated polyvinyl chloride plastic.

3. PE: Polyethylene plastic.

4. PVC: Polyvinyl chloride plastic.

5. PP: Polypropylene

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.

2. Dielectric fittings.

3. Mechanical sleeve seals.

4. Escutcheons.

B. Welding certificates.

1.5 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with Division 01 and the following:

1. Final Submittal:

a. Submit record digital data files and two set(s) of record digital data file plots.

b. Plot each drawing file, whether or not changes and additional information were recorded.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural

Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inchmaximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564, medium body, medium set. Include purple primer according to ASTM F 656. Note: Clear primer will not be allowed.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

J. Polypropylene pipe: Heat fusion as recommended by manufacturer.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.

b. Dresser Industries, Inc.; DMD Div.

c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.

d. Viking Johnson.

2. Underground Piping NPS 1-1/2and Smaller: Manufactured fitting or coupling.

3. Underground Piping NPS 2and Larger: AWWA C219, metal sleeve-type coupling.

4. Aboveground Pressure Piping: Pipe fitting.

B. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.

b. Mission Rubber Company.

c. Plastic Oddities, Inc.

C. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings or comparable product by one of the following:

a. Charlotte Pipe and Foundry Company.

b. Harvel Plastics, Inc.

3. Description:

a. One-piece fitting with manufacturer’s Schedule 80 equivalent dimensions.

b. One end with threaded brass insert and one socket end.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psigminimum working pressure at

180 deg F

1. Manufacturers:

   a. Capitol Manufacturing Company.

   b. Central Plastics Company.

   c. EPCO Sales, Inc.

   d. Hart Industries International, Inc.

   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

   f. Zurn Plumbing Products Group; Wilkins Water Control Products.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psigminimum working pressure as required to suit system pressures.

1. Manufacturers:

   a. Capitol Manufacturing Co.

   b. Central Plastics Company.

   c. Epco Sales, Inc.

   d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

   a. Advance Products & Systems, Inc.

   b. Calpico, Inc.

   c. Pipeline Seal and Insulator, Inc.

   d. Central Plastics Company.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psigminimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psigminimum working pressure at 225 deg F

1. Manufacturers:

a. Capitol Manufacturing Co.

b. Central Plastics Company.

c. Eclipse, Inc.

d. Epco Sales, Inc.

e. Hart Industries, International, Inc.

f. Watts Industries, Inc.; Water Products Div.

g. Zurn Industries, Inc.; Wilkins Div.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psigminimum working pressure at 225 deg F

1. Manufacturers:

a. Perfection Corp.

b. Precision Plumbing Products, Inc.

c. Sioux Chief Manufacturing Co., Inc.

d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Metraflex Co.

d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inchminimum thickness; round tube closed with welded longitudinal joint.

B. Galvanized Steel Pipe: ASTM A53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

E. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

F. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

G. PVC Pipe: ASTM D 1785, Schedule 40.

2.8 WALL PENETRATION SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. SIGMA.

2. Calpico, Inc.

3. CCI PIPING

4. ADVANCED PRODUCTS & SYSTEMS

5. METRAFLEX

6. GARLOCK

B. Description: Wall-sleeve assembly, consisting of housing and gland, gaskets, and pipe sleeve.

1. Carrier-Pipe Deflection: Up to 5 percent without leakage.

2. Housing: Ductile-iron casting with hub, water stop, anchor ring, and locking devices. Include gland, bolts, and nuts.

3. Housing-to-Sleeve Gasket: EPDM rubber.

4. Housing-to-Carrier-Pipe Gasket: AWWA C111, EPDM rubber.

5. Pipe Sleeve: AWWA C151, ductile-iron pipe.

2.9 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Floor-Plate Type: Cast-iron floor plate.

D. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.10 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

c. Insulated Piping: One-piece, stamped-steel type with spring clips.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.

f. Bare Piping in Equipment Rooms: One-piece, cast-brass type.

g. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas, bottoms of shafts, and other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inchannular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. PVC Pipe Sleeves: For pipes smaller than NPS 6

b. Steel Sheet Sleeves: For pipes NPS 6and larger, penetrating gypsum-board partitions.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves. Select sleeve size to allow for 1-inchannular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inchannular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Fire stopping" for materials.

T. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

U. Install wall penetration systems in new, exterior concrete walls.

V. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

W. Verify final equipment locations for roughing-in.

X. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. 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. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. PVC Non-pressure Piping: Join according to ASTM D 2855.

J. PE/PP Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.

2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2and Smaller: Use dielectric couplings, nipples, or unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4Use dielectric flanges.

D. Dielectric Fittings for NPS 5and Larger: Use dielectric flange kits.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2and Smaller: Fitting-type coupling.

2. NPS 2and Larger: Sleeve-type coupling.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Wet Piping Systems: Connect copper branch lines to steel or iron mains as follows: Install steel branch pipe off main with black iron nipple connected to bronze ball valve. Connect bronze ball valve to copper piping with a threaded copper male adapter, which is then soldered to the copper branch line.

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.7 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.10 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 220500

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

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. Ball valves.
2. Butterfly valves
3. Check valves

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

H. SS: Stainless Steel.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating and trim materials; valve design, pressure and temperature classifications; end connections, arrangement, dimensions and required clearances.

B. Maintenance Data: For each type of valve to include maintenance manual specified in Division 01.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain all valves, from a single source, from a single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

2. ASME B31.1 for power piping valves.

3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and/or ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd party certified. Comply with Reduction of Lead in Drinking Water Act "Lead Free Law".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces, grooves, and weld ends.

3. Set angle, and globe valves closed to prevent rattling.

4. Set ball and plug valves open to minimize exposure of functional surfaces.

5. Set butterfly valves closed or slightly open.

6. Block all check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. All valves shall be by the same manufacturer.

C. Lead Free silicon bronze (ASTM listed) valves shall be made with corrosion-resistant materials. Manufacturer shall provide third party certification tested in accordance with EN ISO 6509 regarding dezincification corrosion resistance and stress cracking.

D. Bronze Valves: NPS 2 and smaller with threaded ends, unless noted otherwise.

E. Ferrous valves: NPS 2-1/2 and larger with flanged ends, unless noted otherwise

F. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8and larger.

2. Handwheel: For valves other than quarter-turn types.

3. Handlever: For quarter-turn valves NPS 6and smaller.

I. Valves in Insulated Piping: With 2-inchstem extensions and the following features:

1. Ball Valves: With extended neck and operating handle of non-thermal-conductive material that meets UL 2043 approved for inside air plenum, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation with memory stop that is fully adjustable after insulation is applied.

a. Basis-of-Design Product: NIBCO LF NIB-SEAL (-NS suffix in figure no.) handle extension.

2. Butterfly Valves: With extended neck.

J. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Threaded: With threads according to ASME B1.20.1.

K. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BALL VALVES

A. Two-Piece, Full-Port, Lead-free, Silicon Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. NIBCO INC. # T-585-66-LF-NS - Basis of Design Product.

b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

c. Conbraco Industries, Inc.; Apollo Valves 70LF-140-04 Series

2. Description:

a. Standard: MSS SP-110, ASME A1124.14 and NSF/ANSI-61 & 372 listings.

b. SWP Rating: 150 psig

c. CWP Rating: 600 psig

d. Body Design: Two piece.

e. Body Material: Lead Free Brass and Bronze.

f. Ends: Threaded.

g. Seats: Reinforced PTFE.

h. Stem: Stainless or Carbon Steel with 2-1/4” extension.

i. Ball: Stainless steel, vented.

j. Port: Full.

k. Dezincification resistant.

2.3 SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Ductile-Iron, Lead-Free, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturer: Subject to compliance with requirements, provide products by the following:

a. NIBCO INC. # LD2000N-315 – Basis of Design Product.

b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

c. Conbraco Industries, Inc.; Apollo Valves.

2. Description:

a. Standard: MSS SP-67, Type I.

b. CWP Rating: 200 psig

c. Body Design: Lug type; suitable for bi-directional dead-end service at rated pressure without use of downstream flange.

d. Body Material: ASTM A 536, ductile iron.

e. Seat: EPDM.

f. Stem: One-piece stainless steel.

g. Disc: Lead Free Aluminum-Bronze.

2.4 BRONZE CHECK VALVES

Class 125, Spring Actuated - Bronze Check Valves:

1. Manufacturer: Subject to compliance with requirements, provide products by the following:

a. NIBCO INC # T-480Y-LF – Basis of Design Product.

b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

c. Conbraco Industries, Inc.; Apollo Valves.

2. Description:

a. Standard: Lead-Free Silicon Bronze.

b. CWP Rating: 250 psig.

c. Body Design: Horizontal or vertical flow.

d. Body Material: Silicon Bronze.

e. Ends: Threaded.

f. Disc: PTFE.

g. Stem: Stainless Steel.

h. Spring: Stainless Steel.

i. Listing: NSF.

j. Sizes: NPS 3/8 thru 2.

2.5 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Stockham Division # B13T.

b. NIBCO INC. # T211Y.

c. Milwaukee Valve Company # 502.

2. Description:

a. Standard: MSS SP-80, Type 2.

b. CWP Rating: 200 psig

c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.

d. Ends: Threaded.

e. Stem: Bronze.

f. Disc: PTFE.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron.

i. Dezincification resistant.

B. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Powell # 150.

b. NIBCO INC. # T235Y.

c. Crane Co.; Crane Valve Group; Jenkins Valves # 106A.

2. Description:

a. Standard: MSS SP-80, Type 2.

b. CWP Rating: 300 psig

c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.

d. Ends: Threaded.

e. Stem: Bronze.

f. Disc: PTFE.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron.

i. Dezincification resistant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

F. Unblock check valves prior to installation.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Lift Check Valves: With stem upright and plumb.

2. Spring Loaded Check Valves: In vertical or horizontal position.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly valves.

2. Butterfly Valve Dead-End Service: Single-flange (lug) type.

3. Throttling Service: Ball, or butterfly valves.

4. Pump-Discharge Check Valves: Spring Loaded or Swing Check Valves

a. NPS 2and Smaller for Domestic Water: Bronze body, spring loaded, check valves with nonmetallic disc.

b. NPS 2-1/2and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, resilient-seat check valves.

c. NPS 2-1/2and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Polypropylene Piping, NPS 2and Smaller: Threaded ends.

2. For Polypropylene Piping, NPS 2-1/2 to NPS 4Flanged ends except where threaded valve-end option is indicated.

3. For Polypropylene Piping, NPS 5and Larger: Flanged ends.

4. For Steel Piping, NPS 2and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4Flanged ends except where threaded valve-end option is indicated in valve schedules below.

6. For Steel Piping, NPS 5and Larger: Flanged ends.

END OF SECTION 22 0523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Section 220548 “Seismic Protection” and Section 22 0500 "Common Work Results for Plumbing" all apply to the work of this Section as if fully repeated herein.

1.2 SUMMARY

A. This Section includes hangers and supports for Division 22 piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section “Metals, Structural Steel” for materials for attaching hangers and supports to building structure.
2. Division 21 Section “Standpipe and Sprinkler Systems” for fire-suppression pipe hangers.
3. Division 22 Section “Vibration Isolation” for vibration isolation devices.
4. Division 22 Section “Expansion Fittings and Loops for Plumbing Piping” for pipe guides and anchors.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, “Guidelines on Terminology for Pipe Hangers and

Supports."

1.4 PERFORMANCE REQUIREMENTS

A. If contractor elects to apply channel support systems and/or heavy-duty steel trapezes to support multiple pipes, in lieu of individual supports, then contractor is responsible for design of same capable of supporting combined weight of supported systems, system contents, and test water.

B. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. All pipe hangers, supports, inserts, including hanger/support coatings located within plenum ceilings shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 complying with ASTM E 84.

1.5 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated. Include:

1. Steel pipe hangers and supports.

2. Thermal-hanger shield inserts.

3. Powder-actuated fastener systems.

4. Trapeze pipe hangers. Include Product Data for components.

5. Metal framing systems. Include Product Data for components.

6. Pipe stands. Include Product Data for components.

7. Equipment supports.

B. Shop Drawings: Signed and sealed shop drawings by a qualified professional engineer are required for all custom pipe and equipment hangers and supports, and all supports for piping larger than 20-inch NPS. Show fabrication and installation details and include calculations.

C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Manufactured Pipe Hangers:

a. B-Line Systems, Inc.

b. Carpenter & Patterson, Inc.

c. Grinnell Corp.

d. Michigan Hanger Co., Inc.

e. Tolco division of NIBCO, Inc.

f. Anvil International; a subsidiary of Mueller Water Products Inc.

2. Channel Support Systems:

a. B-Line Systems, Inc.

b. Grinnell Corp.; Power-Strut Unit.

c. Tolco division of NIBCO, Inc.

d. Unistrut Corp.

3. Thermal-Hanger Shield Inserts:

a. Carpenter & Patterson, Inc.

b. Michigan Hanger Co., Inc.

c. Pipe Shields, Inc.

4. Prefabricated Pipe Stands:

a. Miro.

b. Roof Top Blox.

5. Powder-Actuated Fastener Systems:

a. Hilti, Inc.

b. ITW Ramset/Red Head.

c. Simpson Manufacturing Co.; Strong-Tie Anchor Systems Div.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.

2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Trapeze: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

C. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

D. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.

1. Material for piping below ambient temperature: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.

2. Material for piping above ambient temperature: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.

3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.

4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.

5. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 PIPE STANDS

A. Pipe Stands, General: Shop, factory, or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof

installation without membrane penetration.

C. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Base: Stainless steel.

2. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

3. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

D. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Bases: One or more plastic.

2. Vertical Members: Two or more protective-coated-steel channels.

3. Horizontal Member: Protective-coated-steel channel.

4. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

E. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

F. Factory Fabricated Pipe Stands:

1. Description: Polycarbonate resin or UV Polypropylene copolymer “roller bearing, pipe clamp or V shaped cradle”, support with spacers to maintain a minimum of 3 1/2 inches clear under pipe and a maximum of 14 inches to top of pipe.

2. Compact Pipe Stand: One-piece unit for roof installation without membrane penetration.

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.5 MISCELLANEOUS MATERIALS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for

supported loads and building materials where used.

C. Pipe Anchors and Structural Steel: ASTM A 36, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.

2. Properties: Nonstaining, noncorrosive, and nongaseous.

3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT SCHEDULE OF APPLICATIONS

A. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in this Section.

B. Horizontal-Piping Hangers and Supports for the first three hangers/supports or the first 50-feet (whichever is greater) adjacent to pumps: Use spring hangers and supports. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports shall include the following types:

1. Horizontal (MSS Type 54): Mounted horizontally.

2. Vertical (MSS Type 55): Mounted vertically.

3. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

C. Horizontal-Piping Hangers and Supports for individual, insulated pipe runs which are both 2½-inch diameter or larger and 20 feet or longer: Unless otherwise indicated, choose among the following types:

1. Single Pipe Rolls (MSS Type 41): For suspension of pipes from two rods.

2. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes from single rod.

3. Complete Pipe Rolls (MSS Type 44): Where vertical adjustment is not necessary.

4. Adjustable Pipe Roll and Base Units (MSS Type 46): For vertical and lateral adjustment.

D. Horizontal-Piping Hangers and Supports for individual pipe runs less than 20 feet long and all piping 2-inch diameter or smaller, regardless of length: Unless otherwise indicated, choose

among the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1).

2. Yoke-Type Pipe Clamps (MSS Type 2): For pipes NPS 4 and larger.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3).

4. Steel Pipe Clamps (MSS Type 4).

E. Horizontal-Piping Hangers and Supports for individual uninsulated pipe runs of any size or length: Unless otherwise indicated, choose among the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1).

2. Yoke-Type Pipe Clamps (MSS Type 2): For pipes NPS 4 and larger.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3).

4. Steel Pipe Clamps (MSS Type 4).

5. Adjustable Steel Band Hangers (MSS Type 7): For pipes up to NPS 2 only.

6. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For pipes up to NPS 2 only.

7. U-Bolts (MSS Type 24).

F. Vertical-Piping Hangers and Supports for individual, insulated pipe runs which are both 2½-inch diameter or larger and 20 feet or longer: Use spring hangers and supports. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports shall include the following types:

1. Horizontal (MSS Type 54): Mounted horizontally.

2. Vertical (MSS Type 55): Mounted vertically.

3. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

G. Vertical-Piping Hangers and Supports for individual pipe runs less than 20 feet long and all piping 2-inch diameter or smaller, regardless of length: Unless otherwise indicated, choose among the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8).

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): Where longer ends are required.

3. Vertical-Piping Hangers and Supports for individual uninsulated pipe runs of any size or length: Unless otherwise indicated, choose among the following types:

4. Extension Pipe or Riser Clamps (MSS Type 8).

5. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): Where longer ends are required.

H. Hanger-Rod Attachments: Unless otherwise indicated, choose among the following types:

1. Steel Turnbuckles (MSS Type 13).

2. Steel Clevises (MSS Type 14).

3. Malleable-Iron Sockets (MSS Type 16).

4. Steel Weldless Eye Nuts (MSS Type 17).

I. Building Attachments: Unless otherwise indicated, choose among the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to concrete ceiling.

2. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

3. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams.

4. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

5. 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.

6. Side-Beam Brackets (MSS Type 34): For sides of steel beams.

7. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.2 HANGER AND SUPPORT SCHEDULE OF SPACING AND ROD SIZE

A. Steel Piping: Install hangers with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 4 feet; minimum rod size, 3/8 inch.
2. NPS 3/4: Maximum span, 5 feet; minimum rod size, 3/8 inch.
3. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/4: Maximum span, 6 feet; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
8. NPS 3: Maximum span, 12 feet; minimum rod size, 1/2 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 5/8 inch.
10. NPS 6: Maximum span, 12 feet; minimum rod size, 3/4 inch.
11. NPS 8: Maximum span, 12 feet; minimum rod size, 5/8 inch.
12. NPS 10: Maximum span, 12 feet; minimum rod size, 3/4 inch.
13. NPS 12: Maximum span, 12 feet; minimum rod size, 7/8 inch.

B. Copper Tubing: Install hangers with the following maximum horizontal spacing and minimum rod diameters.

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1 1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 3 and NPS 4: 96 inches with 1/2-inch rod.

C. Cast-iron Soil Piping: Install hangers with the following maximum horizontal spacing and minimum rod diameters.

1. NPS 1 1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

D. Install supports for vertical cast-iron soil piping every 15 feet

E. Install vinyl coated hangers for CPVC, and Polypropylene water piping with the following

maximum horizontal spacing and minimum rod diameters:

1. NPS 1and Smaller: 36 inches with 3/8-inchrod.

2. NPS 1-1/4 to NPS 2 inches with 3/8-inchrod.

3. NPS 2-1/2 to 3-1/2: 48 inches with 1/2-inchrod.

4. NPS 4 and NPS 6: 60 inches with 5/8-inchrod.

F. Install hangers for PVC and Chemical Waste piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inchrod.

2. NPS 3: 48 inches with 1/2-inchod.

3. NPS 4 and NPS 5:48 inches with 5/8-inchrod.

4. NPS 6 to NPS 8: 48 inches with 3/4-inchrod.

5. NPS 10 to NPS 12: 48 inches with 7/8-inchrod.

G. Install supports for vertical PVC. Polypropylene and Chemical Waste piping every 48 inches.

H. Rod diameters may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

I. Hanger and support spacing for piping and tubing not listed above shall be according to MSS SP-69 and piping manufacturer’s written instructions.

3.3 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

C. Field assemble and install according to manufacturer's written instructions.

D. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

E. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

F. Field fabricate from ASTM A 36, steel shapes selected for loads being supported. Weld steel

according to AWS D-1.1.

G. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in this Section. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

H. Install powder-actuated drive-pin fasteners in concrete. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

I. Install mechanical-anchor fasteners in concrete. Install fasteners according to manufacturer's written instructions.

J. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

K. Install hangers and supports to allow controlled thermal 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.

L. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane. Adhere pipe support to roof membrane with an adhesive that is approved by the pipe stand and roofing manufacturer.

2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section “Roof Accessories” for curbs.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, “Building Services Piping,” is not exceeded.

3.4 PROTECTION OF INSULATED PIPING

A. Do not exceed pipe stress limits according to ASME B31.9.

B. Piping Operating above Ambient Air Temperature: Clevis- and clamp-type supports may project through insulation. For piping on roller-type supports, install MSS SP-58, Type 39 protection saddles, and fill interior voids with insulation that matches adjoining insulation.

1. Option: Thermal-hanger shield inserts may be used. Insert shall be same thickness as adjoining pipe insulation and length shall be at least as long as the protective shield.

Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

C. Piping Operating below Ambient Air Temperature: Install MSS SP-58, Type 40 protective shields.

D. Pipe Sizes NPS 4 and larger: Include thermal-hanger shield inserts. Insert shall be same thickness as adjoining pipe insulation and length shall be at least as long as the protective shield. Include steel weight-distribution plate if pipe is installed on rollers.

E. Shield Dimensions for Pipe: Not less than the following:

1. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

2. NPS 4: 12 inches long and 0.06 inch thick.

3. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

4. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

5. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

3.5 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.6 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes 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 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 contours

of welded surfaces match adjacent contours.

3.7 ADJUSTING

A. Hanger Adjustment: 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 1½ inches.

3.8 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

B. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

C. Touch Up Paint: Touchup paint for field welds, bolted connections, and abraded areas on miscellaneous metal is specified in Division 09 Section “Painting.”

D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 APPLICABILITY

A. Seismic supports and restraints shall be provided for all of the following systems:

1. Piping systems.

1.3 SUMMARY

A. Description of Work: The purpose of this section is to define seismic restraint requirements for plumbing systems, equipment and devices, hereinafter referred to as components.

B. This Section does not specify seismic force resisting systems for building structures and structural elements, which are addressed in Divisions 03 through 06.

C. The requirements for seismic protection specified herein are in addition to any requirements for support and/or seismic protection specified in other sections of these specifications.

D. The Contractor shall be responsible for developing details to provide proper support of equipment and devices in accordance with the requirements specified herein.

E. The Contractor shall not proceed with installation of equipment nor seismic protection system until all applicable submittals required by this section have been completed.

F. This section includes the following:

1. Applicable Code.

2. Project-specific Code Coefficients

3. Rigid Support Items.

4. Non-rigid Support Items.

5. Sway Braces.

6. Anchors, Bolts and Clamps.

7. Restraining Cables.

8. Seismic Snubbers.

9. Installation Requirements.

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

1. Division 05 Section “Metal Fabrications” for materials to anchor equipment piping to building structure.

2. Division 07 Section “Roof Accessories” for roof equipment supports.

3. Division 09 Section “Painting” for field-applied painting requirements.

4. Division 22 Section “Common Work Results for Plumbing” for general plumbing requirements.

5. Division 22 Section **“**Hangers and Supports” for piping and equipment supports.

6. Division 22 Section “Vibration Isolation” for vibration-isolation hangers, supports and flexible connectors.

7. Division 22 Section “Insulation” for pipe insulation.

8. All Division 22 Sections for plumbing equipment and systems requiring seismic protection.

1.4 DEFINITIONS

A. Terminology used in this section is defined in ASCE/SEI 7-05: Minimum Design Loads for Buildings and Other Structures.

B. OSHPD: Office of Statewide Health Planning & Development for the State of California.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D

2. Assigned Seismic Use Group or Building Category as Defined in the IBC:

a. Seismic Use Group: II

b. In subparagraph below, retain Seismic Use Group or Building Category for Project structure from three classifications defined in the IBC.

c. Component Importance Factor: 1.0

d. Component Response Modification Factor: See Structural plans

e. Component Amplification Factor: See Structural plans.

3. Design Spectral Response Acceleration at Short Period (0.2 Second): See Structural plans.

4. Design Spectral Response Acceleration at 1.0-second period: See Structural plans.

1.6 SUBMITTALS

A. The Engineer shall receive one copy of all submittal data supplied to the Owner as required in this specification. It is the responsibility of the Contractor to provide seismic protection as outlined herein. Receipt by the Engineer of a copy of the submittals is to verify conformance to the submittal requirements set forth in this specification section. It is not an admission by the Engineer as to the accuracy or completeness of the calculations submitted and equipment proposed.

B. Prior to installation of equipment and devices requiring seismic restraints, the Contractor shall submit required documentation and details at the shop drawing review stage to the Owner. Submit the following in accordance with conditions of contract and Division 01 specification sections.

C. Product data: Include installation details and instructions for each type of seismic support and restraint. Submit equipment support and restraint schedule showing size, location, and features for each required support and restraint.

D. Product certificates: Signed by the manufacturer of seismic supports and restraints certifying that their products meet the specified requirements.

E. Shop Drawings: Calculations and Drawings signed and sealed by a qualified professional engineer registered to practice in the State of Missouri shall be provided for the installation details of each piece of equipment. Include the following:

1. Design Calculations: Calculate requirements for selecting seismic restraints.

a. Exception: Certified and stamped calculations are not required for seismic-restrained systems which have been pre-approved by OSHPD or comply with ANSI Standard Seismic Restraint Manual; Guidelines for Mechanical Systems, as issued by the Sheet Metal and Air Conditioning Contractors National Association, Inc., 1998; Chantilly, Virginia including Addendum 1 issued 2000. A signed letter on Contractor’s letterhead shall be provided as part of the submittal process stating which approved systems are being utilized.

2. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

3. Assembly-type shop drawings: For each type of seismic support and restraint, indicate dimensions, weights, required clearances, and methods of assembly of components. Submittal Drawings shall indicate in complete detail size, type, material grade, locations and dimensions; and shall show construction details, reinforcement, anchorage and

installation with relation to the building construction. Submittals shall include, but not be limited to sway braces, flexible couplings or joints, resilient type vibration devices, and anchorage of concrete equipment pads to structure.

4. Where seismic anchors and braces for one component must unavoidably be attached to two or more elements of a structure subject to differential movement, such as a wall and a floor or two different floors, submit sealed calculations for relative displacements; including selection of sufficient flexible fittings to accommodate the relative displacement. Examples subject to relative displacement include vertical pipe risers; or a pump anchored to a floor and rigidly connected to piping anchored to the roof structure above.

F. Welder certificates: Signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article.

G. Maintenance data: For seismic supports and restraints for inclusion in Operating and Maintenance Manual specified in Division 01.

H. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

I. Contractor's Acknowledgement of Seismic Responsibility: Submit written contractor's statement of responsibility prior to commencement of the work, acknowledging an awareness of the seismic restraint requirements of the project, that control will be exercised to obtain conformance with the Construction Documents, listing procedures for exercising control over the seismic restraint installation, and identifying the responsible person(s) within their organization.

1.7 QUALITY ASSURANCE

A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "R" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred.

Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and one test or analysis at 45 degrees to the weakest mode.

B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.8 REFERENCES

A. Regulatory Requirements: Comply with applicable codes pertaining to product materials and installation of seismic supports and restraints.

B. Referenced Codes and Standards: All work provided under this section shall comply with the requirements specified herein, and additionally as provided in the following Codes and Standards. In all cases where conflicting requirements are provided within these specifications, Codes and Standards, the most stringent requirement shall apply.

1. IBC 2009: Comply with the International Building Code.

2. ASCE/SEI 7-05: Comply with Minimum Design Loads for Buildings and Other Structures.

3. American Institute of Steel Construction (AISC) "Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design", with Commentary and Supplements.

4. NFPA Compliance: Seismic supports and restraints shall comply with NFPA standard No. 13 when used as a component of a fire protection system.

5. UL and FM Compliance: Seismic supports and restraints shall be listed and labeled by UL and FM where used for fire protection piping systems.

6. ANSI/SMACNA: All seismic restraints for piping shall comply with ANSI Standard Seismic Restraint Manual; Guidelines for Mechanical Systems, as issued by the Sheet Metal and Air Conditioning Contractors National Association, Inc., 1998; Chantilly, Virginia; including Addendum 1 published 2000. A seismic hazard level A (SHL-A) shall be utilized.

7. ANSI Standards and ASTM Publications: Seismic supports and restraints shall comply with American National Standards Institute, Inc. (ANSI) and the American Society for Testing and Materials (ASTM) Publications.

a. B18.2.1-1981 Square and Hex Bolts and Screws Inch Series

b. B18.2.2-1972 Square and Hex Nuts (R 1983)

c. A 36-84a Structural Steel

d. A 307-86a Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

e. A 325-86a High-Strength Bolts for Structural Steel Joints

f. A 501-84 Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

g. A 576-87 Steel Bars, Carbon, Hot-Wrought, Special Quality

8. Federal Specification: Seismic supports and restraints shall comply with Federal Specification RR-W-410D for Wire Rope and Strand.

9. "Tri-Service Manual", TM-5809-10, NAVFAC P-365, AFM 88-3, Chapter 13, Departments of Army, Navy and Air Force, Government Printing Office, Washington, D.C.

10. Public Law 95-124 & 101-614 "Earthquake Hazards Reduction Act" and Executive Order 12699; NEHRP (FEMA) Standard "Recommended Provisions for the Development of Seismic Regulations for New Buildings"; National Earthquake Hazards Reduction Program of the Federal Emergency Management Association, Washington, D.C.

1.9 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.10 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. Seismic Snubber Units: Furnish replacement neoprene inserts for all snubbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.

2. B-Line Systems, Inc.

3. California Dynamics Corp.

4. Kinetics Noise Control, Inc.

5. Loos & Co., Inc.; Cableware Technology Division.

6. Mason Industries, Inc.

7. Tolco division of NIBCO, Inc.

8. Unistrut Diversified Products Co.; Wayne Manufacturing Division.

9. Vibration Eliminator Co., Inc.

10. Vibration Isolation Co., Inc.

11. Vibration Mountings & Controls/Korfund.

B. All seismic restraint devices of any one general group; raceways or suspended equipment, or switchgear or other floor mounted equipment, etc., shall be provided by a single manufacturer.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

C. Bolts and Nuts: Square and hex bolts and nuts, ANSI B18.2.1 and B18.2.2, SAE Grade 5, and ASTM A 307 or A 325.

1. Underground bolts shall be galvanized.

D. Sway Brace: Material used for members listed in Table I of this specification, except for pipes, shall be structural steel conforming with ASTM A 36. Steel pipes shall conform to ASTM A 501. Note additional exception below.

TABLE I

MAXIMUM LENGTH AND ALLOWABLE CONCENTRIC LOADS FOR SWAY BRACES

Type	Size	Maximum Length*	Allowable Concentric Load* (kips)
Angles	1½" x 1½" x ¼"	4'-10"	3.4
	2" x 2" x ¼"	6'-6"	4.6
	2½" x 2½" x ¼"	8'-2"	5.9
	3" x 3" x ¼"	9'-10"	7.1
Rods	¾"	3'-1"	2.2
	7/8"	3'-7"	3.0
Pipes (40S)	1"	6'-9"	2.4
	1¼"	8'-8"	3.3
	1½"	10'-1"	3.9
	2"	12'-9"	5.3
	2½"	15'-4"	8.4
	3"	19'-0"	11.0

*Based on the slenderness ratio of 1/r = 200, and load applied concentrically to brace. The tabulated load values include a 33% stress increase as permitted for seismic loads. For non-concentric loading, allowable brace load is to be determined per the AISC Specification for Structural Steel Buildings / ASD 1989.

1. Contractor's Option: In lieu of utilizing angles, rods, bars or pipes as noted in Table I, U-channel systems consisting of channels, fittings and accessories may be utilized. The u-channel system shall be manufactured as a complete system by one supplier and listed by the manufacturer for use in seismic restraint application. The system shall have the approval of OSHPD. The equipment shall provide multi-directional bracing of plumbing piping systems.

E. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Cables shall conform to Fed. Spec RR-W-410 as follows:

1. 5/32 inch diameter Type V, Class 1

2. 3/16 inch to 5/16 diameter Type V, Class 2

3. 1/4 inch to 5/8 diameter Type I, Class 2

F. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.

G. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

H. Flexible Couplings: Flexible couplings shall have same pressure ratings as adjoining pipe.

I. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix ratio shall be 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

J. Galvanizing Repair Paint: High-zinc-dust-content paint, with dry film containing not less than 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Examine substrates and conditions under which seismic supports and restraints are to be installed

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

3.2 SEISMIC PROTECTION, GENERAL

A. Attachments and supports for plumbing systems and components shall be designed to resist the seismic forces specified herein.

B. Plumbing systems and components shall be designed by their manufacturer to consider dynamic effects of the equipment and its contents. Design, selection, and installation of seismic bracing for plumbing systems and components shall account for interaction between equipment and

supporting structures, and the effect imposed by attached utility or service lines, and shall ensure that impact between components is avoided during a seismic event.

C. Anchorage: Install seismic supports and restraints complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

1. Friction resulting from gravity loads shall not be considered to provide resistance to seismic loads.

2. All bolts, including fasteners and anchor bolts, used for attachment of anchors to components and to structure shall be sized for the seismic forces described in Part I but shall not be less than ½-inch diameter in any case.

3. Powder-driven fasteners and shot pins shall not be permitted in tension load applications.

4. Expansion anchors, other than undercut expansion anchors, shall not be permitted to anchor non-vibration isolated equipment rated over 10 horsepower.

5. Anchorage Embedment Depth: Not less than eight times the anchorage diameter.

6. Anchorage Edge Distance: Place anchorage not less than ten times the anchorage diameter from edge of concrete housekeeping pad.

3.3 PIPES

A. General: Select and install restraints for piping in complete and strict accordance with ANSI Standard Seismic Restraint Manual; Guidelines for Mechanical Systems, as issued by the Sheet Metal and Air Conditioning Contractors National Association, Inc., 1998; Chantilly, Virginia including Addendum 1 published 2000; except where more stringent requirements are described herein.

B. Transverse Sway Bracing: Transverse sway bracing shall be provided at each horizontal turn of 45 degrees or more, at the end of each pipe run, and otherwise at regular intervals spaced no further than required by the above Standard. Sway bracing shall be provided at closer intervals if so recommended by U-channel manufacturer when using U-channel systems.

C. Longitudinal Sway Bracing: Longitudinal sway bracing shall be provided at regular intervals spaced no further than required by the above Standard. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section connected perpendicular to it, if the bracing is installed within 4 feet of the intersection, and if it is sized for the larger pipe. Sway bracing shall be provided at closer intervals if so recommended by U-channel manufacturer when using U-channel systems.

D. Anchor Rods, Angles, and Bars: Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as required.

E. Restraining Cables: Install restraining cables slightly slack. Install cables so they do not bend

across sharp edges of adjacent equipment or building structure.

F. Hanger Rod Reinforcement: Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe and equipment hangers where required. Do not weld angles to rods.

G. Clamps: Clamps on uninsulated pipes shall be applied directly to pipes. Insulated piping shall have clamps applied over insulation vapor barrier with high-density inserts and metal protection shields under each clamp. Vapor barrier shall not be punctured.

1. At trapeze anchor locations, shackle or clamp piping to trapeze.

H. Vertical Runs: Vertical runs of piping shall be braced at each floor and roof level. Provide intermediate lateral braces at 13 foot maximum spacing where story height exceeds 13 feet.

I. Spreaders: Required between racked or adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 4 inches (or four times the maximum displacement due to seismic force) apart. Spreaders shall be applied at same interval as sway braces. Spreaders shall be applied to surface of bare or insulated hot pipe, and over insulation utilizing high-density inserts and pipe protection shields where vapor-barrier-type insulation is employed.

J. Flexible Couplings or Joints: Flexible couplings and joints of the mechanical joint type may be used for aboveground and underground piping. Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers larger than 3½ inches in diameter. Cast-iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets or no-hub fittings may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to comply with these requirements.

K. Mechanical couplings for steel or cast-iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion, contraction, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.

L. Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets. Underground bolts shall be galvanized.

3.4 SEISMIC RELATIVE DISPLACEMENT

A. Do not attach seismic anchorage or bracing for any one component to two or more elements of a structure subject to differential movement, such as a wall and a floor or two different floors. Do not attach seismic anchorage or bracing for any one component to two or more separate structures or structural systems.

B. Piping shall be designed to accommodate differential movement between components and structures when attached to structures that could displace relative to each other and where the components cross a seismic isolation interface. Examples include vertical pipe risers; or a pump anchored to a floor and rigidly connected to piping anchored to the roof structure above.

1. Furnish and install sufficient flexible fittings to accommodate the relative displacement.

3.5 ADJUSTING

A. Support and Restraint Adjustment: Adjust supports and restraints to distribute loads equally on attachments.

B. Adjust snubbers according to manufacturer's written recommendations.

C. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

D. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.6 CLEANING

A. After completing equipment installation, inspect seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

B. Paint Touch-Up: Immediately after installation of equipment, devices and seismic protection system; clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas per requirements in Division 09 section "Painting".

C. Galvanizing Touch-Up: Immediately after installation of equipment, devices and seismic protection system; clean field welds, bolted connections, and abraded areas of galvanizing. Apply galvanizing repair paint to comply with ASTM A 780.

3.7 FIELD QUALITY CONTROL

A. Review: Engage an authorized representative of the seismic restraint vendor to perform the following field quality control review:

1. Examine all plumbing systems and equipment to confirm all seismic-restraint systems are installed properly and in compliance with these specifications and the submittals.

2. Examine all seismic restraints and seismic snubbers for minimum clearances.

3. Examine all cable bracing systems for proper installation, angle of slope, and tension or slack.

B. Report: Submit a certification report of the authorized representative of the seismic restraint vendor to verify the above review and to include the following:

1. Certify that all seismic-restraint systems are installed properly and in compliance with these specifications and the submittals.

2. Identify those areas that require corrective measures or certify that no corrective measures are necessary.

3. Any changes to the originally submitted seismic restraint designs, such as those due to field coordination, shall be clearly defined and detailed in the report.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Equipment labels.

2. Warning signs and labels.

3. Pipe labels.

4. Valve tags.

5. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Aluminum, 0.032-inchor anodized aluminum, 0.032-inchminimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: Black.

3. Background Color: White.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Designations shall be in both English and Spanish.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

E. All labels and pipe markers located within plenum ceilings shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 complying with ASME E 84.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations as used on Drawings to include pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: Minimum 1-1/2 -inches high.

E. Stencils will not be allowed.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inchletters for piping system abbreviation and 1/2-inchnumbers.

1. Tag Material: Brass, 0.032-inchminimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as **"DANGER," "CAUTION,"** or **"DO NOT OPERATE".**

4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION Retain first paragraph below to identify piping systems by color-coded painting. Labels will still be required to identify service, pipe size, and flow direction.

A. Piping Color-Coding: Where required painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 25 feet along each run (horizontal and vertical). Reduce intervals to 15 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Potable Domestic Water Piping:

a. Background Color: Green

b. Letter Color: White

2. Sanitary Waste and Storm Drainage Piping:

a. Background Color: White.

b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule. Submit valve schedule to Engineer and Owner’s Representative at substantial completion.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. All Systems: 1-1/2 inches, round.

2. Valve-Tag Color:

a. Water: Green.

b. Air/Gas: Blue

c. Non Potable: Black

3. Incised Letter Color:

a. All Systems: White.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220700 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Section 22 0548 “Seismic Protection” and Section 22 0100 “Common Work Results for Plumbing” all apply to the work of this Section as if fully repeated herein.

C. Section 22 40 00 “Plumbing Fixtures” apply to this section.

1.2 SUMMARY

A. This Section includes plumbing insulation for equipment, piping, valves, specialties and other installations, including the following:

1. Insulation Materials:

   a. Mineral-Fiber, blanket or preformed pipe insulation.

   b. Flexible Elastomeric Insulation.

   c. Molded Vinyl.

2. Insulating cements.

3. Adhesives.

4. Mastics.

5. Sealants.

6. Factory-applied jackets.

7. Field-applied wraps.

8. Tapes.

9. Securements.

10. Corner angles.

B. Section includes insulating the following plumbing piping services:

1. Domestic Potable and non-Potable cold-water piping including fittings, valves and specialties.

2. Domestic Potable hot-water and recirculating Potable hot water piping including fittings, valves and specialties.

3. Sanitary sewer and indirect waste piping.

4. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 DEFINITIONS

1. ASJ: All-service jacket.

2. FSK: Foil, scrim, kraft paper.

3. SSL: Self-sealing lap.

4. PVDC: Polyvinylidene chloride.

5. IP: Iron pipe.

6. CTS: Copper Tube Size.

B. Thermal Resistivity: "R-values" represent the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between two exposed faces required to cause one BTU to flow through one square foot of material, in one hour, at a given mean temperature.

C. Refer to Section 22 05 00 for definitions of finished, interior, exterior, exposed, and concealed locations.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any). Denote material thickness and usage.

B. Shop Drawings: Show details, product data sheet, system performance and Code compliance for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Insulation application at pipe expansion joints for each type of insulation.

3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

4. Removable insulation at piping specialties, equipment connections, and access panels.

5. Application of field-applied jackets.

6. Application of field-applied wraps.

7. Application at linkages of control devices.

8. Field application for each pipe and equipment type.

C. Samples: For each type of insulation, wrap and jacket indicated. Identify each Sample, describing product and intended use.

D. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.

E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, wraps and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. Field quality-control inspection reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index (FSI) of 25 or less, and smoke-developed index (SDI) of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index (FSI) of 75 or less, and smoke-developed index (SDI) of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section “Hangers and Supports.”

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Fiberglass Insulation:

a. Johns Manville; Micro-Lok.

b. Owens Corning; Fiberglas Pipe Insulation.

c. Knauf Insulation Inc.; Alley-K

2. Flexible Elastomeric Insulation:

a. Aeroflex USA, Inc.; Aerocel.

b. Armacell LLC; AP Armaflex.

c. RBX Corporation, Insul-Sheet 1800 and Insul-tube 180.

3. Molded Vinyl:

a. Truebro.

b. Plumberex Specialties Product, Inc.

Proflo.

4. Insulating Cements: Same as insulation manufacturer, or

a. Insulco, Division of MFS, Inc.

b. P. K. Insulation Mfg. Co., Inc.

c. Rock Wool Manufacturing Company.

5. Sealants, Adhesives and Mastics: Same as insulation manufacturer, or

a. Childers Products, Division of ITW.

b. Foster Products Corporation, H. B. Fuller Company.

c. Marathon Industries, Inc.

6. Field-Applied Fire Wrap: Same as insulation manufacturer, or

a. 3M Fire Barrier.

b. FyreWrap, Unifrax LLC.

c. Armacell

7. Tapes: Same as insulation manufacturer, or

a. Avery Dennison Corporation, Specialty Tapes Division.

b. Compac Corp.

c. Ideal Tape Co., Inc., an American Biltrite Company.

8. Bands and Wire: Same as insulation manufacturer, or

a. ACS Industries, Inc.

b. C & F Wire.

c. Childers Products.

9. Insulation Pins and Hangers: Same as insulation manufacturer, or

a. AGM Industries, Inc.

b. GEMCO.

c. Midwest Fasteners, Inc.

2.3 INSULATION MATERIALS

A. Refer to Schedule in Part 3 for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process and shall be formaldehyde free, low VOC, fiber free, dust free and resist mold and mildew.

F. Adhesives shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to it and to surfaces to be insulated, unless otherwise indicated.

G. Fiberglass: Type 1, 850 Deg F materials. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I for tubular materials and Type II for sheet materials.

1. Thermal Conductivity: 0.28 average maximum at 75º F mean temperature.

2. Adhesive: Comply with MIL-A-24179A, Type II, Class I.

H. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Thermal Conductivity: 0.28 average maximum at 75ºF mean temperature.

2. Adhesive: Comply with MIL-A-24179A, Type II, Class I.

I. Molded Vinyl:

1. Where lavatories/sinks are noted to be ADA compliant, furnish the following: safety covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed-cell vinyl construction, white color, for insulating tailpiece, P-trap, valves and supply piping. Furnish with weephole and angle valves access covers.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 permat 43-mildry film thickness.

2. Service Temperature Range: Minus 20 to plus 180ºF

3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 permsat 0.0625-inchdry film thickness.

2. Service Temperature Range: Minus 20 to plus 200ºF

3. Solids Content: 63 percent by volume and 73 percent by weight.

4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Permanently flexible, elastomeric sealant.

3. Service Temperature Range: Minus 100 to plus 300ºF

4. Color: White or gray.

2.6 FIELD-APPLIED WRAPS

A. Lightweight, non-asbestos, high temperature, inorganic, foil encapsulated insulation tested and listed for use in return air plenums.

B. Performance Requirements:

1. Single layer system of 1/2” thick material.

2. Meets UL 1887 test criteria.

3. Meets 25/50 ratings per ASTM E-84, UL/ULC 723.

4. Fire wrap and combustible item must be tested as an assembly.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Width: 3 inches.

2. Thickness: 11.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2 percent.

5. Tensile Strength: 40 lbf/inches in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. Width: 3 inches.

2. Thickness: 6.5 mils.

3. Adhesion: 90 ounces force/inchin width.

4. Elongation: 2 percent.

5. Tensile Strength: 40 lbf/inchesin width.

6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.

2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.

4. Elongation: 500 percent.

5. Tensile Strength: 18 lbf/inches in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Width: 2 inches.

2. Thickness: 3.7 mils.

3. Adhesion: 100 ounces force/inchin width.

4. Elongation: 5 percent.

5. Tensile Strength: 34 lbf/inchesin width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Width: 3 inches.

2. Film Thickness: 6 mils; except 4 mils where used indoors.

3. Adhesive Thickness: 1.5 mils.

4. Elongation at Break: 145 percent.

5. Tensile Strength: 55 lbf/inches in width.

2.8 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2

inch wide with wing or closed seal.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.

3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch

b. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.

b. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches

c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

b. Spindle: Copper, aluminum, or stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

c. Adhesive-backed base with a peel-off protective cover.

C. Wire: 0.062-inchsoft-annealed, stainless steel.

2.9 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with

adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install plenum wrap insulation system in accordance with manufacturer’s written installation instructions.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. At the following locations, omit jacket and provide a separate cutaway removable segment of insulation clearly labeled “Access.” For below-ambient services, provide a design that allows access but maintains vapor barrier.

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Manholes.

5. Handholes.

6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches

1. Firestopping and fire-resistive joint sealers are specified in Division 07 Section “Through-Penetration Firestop Systems.”

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies according to Division 07 Section “Through-Penetration Firestop Systems.”

3. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.5 PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. If furnished in half sections, orient longitudinal joints at 3 and 9 o'clock positions on the pipe.

2. All insulation shall be tightly butted and free of voids and gaps at all joints.

3. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation, not to exceed 1-1/2-inchthickness.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

3. Cut sectional pipe insulation to fit. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

E. Insulation Installation on Valves, Strainers, Unions, and Specialties:

1. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation over valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

4. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

5. Insulate unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

7. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

8. Label the outside insulation jacket of each union with the word “UNION.” Match size and color of pipe labels.

F. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

G. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

H. Special Requirements for Flexible Elastomeric Insulation Installation:

1. Seal all transverse seams, longitudinal seams, end joints, and section joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.7 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

B. Hot Surfaces: For piping services denoted as 140ºF or greater, all piping surfaces including but not limited to pipe, flanges, fittings, valves of every kind, strainers, unions, and other appurtenances shall be insulated to avoid potential for personnel injury via contact with hot surface.

1. Field-installed jackets, where required, shall be installed in removable segments at valves, strainers, unions, and similar specialties.

C. Cold Surfaces: For piping surfaces operating below surrounding ambient temperature, all piping surfaces including but not limited to pipe, flanges, fittings, valves of every kind, strainers, unions, and other appurtenances shall be insulated and shall include uninterrupted vapor barrier to avoid potential condensation.

3.9 PIPE INSULATION SCHEDULE, INDOORS

A. Domestic Potable and Non-Potable Cold Water – ***Copper Piping only***:

1. NPS 1and Smaller: Insulation shall be either of the following:

   a. Flexible Elastomeric: 1 inch thickness.

2. NPS 1-1/4 to NPS 4: Insulation shall be either of the following:

   a. Flexible Elastomeric: 1-1/2 inch thickness.

3. NPS 5 and Larger: Insulation shall be either of the following:

   a. Flexible Elastomeric: 1-1/2 inches thickness.

B. Domestic Potable Hot and Domestic Potable Recirculated Hot Water – ***Copper Piping only:***

1. NPS 1-1/4 and Smaller: Insulation shall be of the following:

   a. Flexible Elastomeric: 1 inch thick. CTS sizes.

2. NPS 1-1/2 to NPS 4: Insulation shall be the following:

   a. Flexible Elastomeric: 1-1/2 inch thick. CTS sizes.

3. NPS 5 and Larger: Insulation shall be the following:

   a. Flexible Elastomeric: 1-1/2 inches thick. CTS sizes.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. Insulation shall be of the following:

   a. 1/8 inch thick, rigid high-impact material, white, antimicrobial molded vinyl cover.

D. Floor Drains, Traps, and Sanitary Drain Piping within 20 Feet of Drain Receiving Condensate and Equipment Drain Water below 60ºF

1. NPS 4 and Smaller: Insulation shall be either of the following:

   a. Fiberglass: 3/4 inch thick.

2. NPS 5 and Larger: Insulation shall be either of the following:

   a. Fiberglass: 1-1/2 inches thick.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Except as noted below, apply the following field jackets:

1. Equipment: Aluminum, Stucco Embossed, 0.016 inch thick.

2. Piping: PVC, 30 mils thick.

C. Field jackets are not required in the following cases:

1. Equipment if concealed from view.

2. Equipment if rigid board insulation is applied and if 84” or greater above floor.

3. Equipment if installed in unfinished space and if 84” or greater above floor.

4. Equipment on applications where vapor barrier is not required (e.g., hot water pumps).

5. Piping if concealed from view.

6. Piping if installed in unfinished space 84” or greater above floor.

7. Piping on applications where vapor barrier is not required (e.g., hot water piping).

8. Piping insulated with a material other than mineral-fiber.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

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. Specialty valves.

2. Flexible connectors.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to 22 0548 "Seismic Protection."

1.4 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.

2. Flexible connectors.

B. Water Samples: Specified in "Cleaning" Article.

C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Fire-suppression-water piping.

2. Domestic water piping.

3. HVAC hydronic piping and ductwork.

4. Soil, waste and vent piping.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components. Comply with Reduction of Lead in Drinking Water Act “Lead Free Law”.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect, Construction Manager and Owner no fewer than two weeks in advance of proposed interruption of water service.

2. Do not proceed with interruption of water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard drawn, seamless, Copper Tube: ASTM B 88, Type L water tube.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

B. Copper Unions:

1. MSS SP-123.

2. Cast-copper-alloy, hexagonal-stock body.

3. Ball-and-socket, metal-to-metal seating surfaces.

4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.5 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose Co., Inc.

2. Flexicraft Industries.

3. Flex Pression, Ltd.

4. Flex-Weld, Inc.

5. Mercer Rubber Co.

6. Metraflex, Inc.

7. Unaflex, Inc.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig

2. End Connections NPS 2and Smaller: Threaded copper pipe or plain-end copper tube.

3. End Connections NPS 2-1/2and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig

2. End Connections NPS 2and Smaller: Threaded steel-pipe nipple.

3. End Connections NPS 2-1/2and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install domestic water piping level without pitch and plumb.

F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

G. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Seismic Protection" for seismic-restraint devices.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping adjacent to equipment and specialties to allow service and maintenance.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and

specialty.

Q. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

R. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

S. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.

H. Steel-Piping Grooved Joints: Cut or roll groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

I. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use valves for piping NPS 2and smaller. Use butterfly valves for piping NPS 2-1/2and larger. Gate valves will not be allowed.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.

2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

3. Install drain valves at the base of all water risers per the following schedule:

a. ½ inch to 1-1/2 inch risers use ½ inch drain valves.

b. 2 inches and larger risers use 1 inch drain valves.

D. Install calibrated balancing valves in each hot-water circulation return branch and suction side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.4 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42 clamps.

2. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

   b. Longer than 100 Feet MSS Type 43, adjustable roller hangers.

   c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4and smaller: 60 inches with 3/8-inchrod.

2. NPS 1 and NPS 1-1/472 inches with 3/8-inchrod.

3. NPS 1-1/2 and NPS 296 inches with 3/8-inchrod.

4. NPS 2-1/2108 inches with 1/2-inchrod.

5. NPS 3 to NPS 510 feet with 1/2-inchrod.

6. NPS 610 feet with 5/8-inchrod.

F. Install supports for vertical copper tubing every 10 feet

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4and Smaller: 84 inches with 3/8-inchrod.

2. NPS 1-1/2108 inches with 3/8-inchrod.

3. NPS 2: 10 feet with 3/8-inchrod.

4. NPS 2-1/2: 11 feet with 1/2-inchrod.

5. NPS 3 and NPS 3-1/212 feet with 1/2-inchrod.

6. NPS 4 and NPS 5: 12 feet with 5/8-inchrod.

7. NPS 612 feet with 3/4-inchrod.

8. NPS 8 to NPS 12: 12 feet with 7/8-inchrod.

H. Install supports for vertical steel piping every 15 feet

I. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.

2. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved in writing by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.

3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to

provide flow of hot water in each branch.

b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

8. Check plumbing specialties and verify proper settings, adjustments, and operation.

9. Bleed air from entire system.

3.10 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

   b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic and non-potable water piping, NPS 2and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L wrought- copper solder-joint fittings; and brazed or soldered joints.

D. Aboveground domestic water piping, NPS 2-1/2 to NPS 4shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L wrought- copper solder-joint fittings; and brazed joints.

2. Hard copper tube, ASTM B 88, Type L; grooved-joint copper-tube appurtenances; and grooved joints.

E. Aboveground domestic water piping, NPS 5 to NPS 8shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L wrought-copper solder-joint fittings; and brazed joints.

2. Hard copper tube, ASTM B 88, Type L; grooved-joint copper-tube appurtenances; and grooved joints.

3. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2and larger.

2. Throttling Duty: Use ball or globe valves for piping NPS 2and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2and larger.

3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves, variable orifice adjustment.

4. Drain Duty: Male hose-end drain valves.

B. Use spring loaded check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 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 domestic water piping specialties:

1. Strainers

2. Hose bibs.

3. Outlet boxes.

4. Drain valves.

5. Water hammer arresters.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages" for thermometers, pressure gages, and flow meters in domestic water piping.

2. Division 22 Section "Domestic Water Piping" for water meters.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

1.4 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 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. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.

2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

3. Comply with Reduction of Lead in Drinking Water Act “Lead Free Law”.

C. All Thermostatic Mixing Valves shall be factory engraved with ASSE 1071. Stamping on valves or letters on factory letterhead will not be acceptable compliance.

PART 2 - PRODUCTS

2.1 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. NIBCO INC. # T-221/222-A NPS 3 and smaller.

b. NIBCO INC. # F-721-A, NPS 4 and larger.

c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

d. Conbraco Industries, Inc.; Apollo Valves

e. Pressure Rating: 200 psig CWP, unless otherwise indicated.

2. Body: Bronze for NPS 3and smaller; Cast-Iron for NPS 4 and larger.

3. End Connections: Threaded for NPS 3and smaller; flanged for NPS 4and larger.

4. Screen: Stainless steel with round perforations, unless otherwise indicated.

5. Threads: ANSI B1.20.1.

6. Flange: ANSI B16.1.

7. Dezincification resistant.

8. Drain: Factory-installed.

2.2 HOSE BIBBS

A. Hose Bibs (**HB-1**):

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Woodford Manufacturing Company.

b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

c. Watts Drainage Products Inc.

2. Basis of Design Model: Woodford model #24.

3. Standard: ASME A112.18.1 for sediment faucets.

4. Body Material: Bronze.

5. Seat: Bronze, replaceable.

6. Supply Connections: NPS 1/2 or NPS 3/4threaded inlet see plans.

7. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.

8. Pressure Rating: 125 psig

9. Vacuum Breaker: Integral non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011 on all HB-1.

10. Finish for Equipment Rooms: Rough bronze, chrome or nickel plated.

11. Operation for Equipment Rooms: Wheel handle.

2.3 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.

2. Pressure Rating: 400-psigminimum CWP.

3. Size: 1/2 inch for risers 1/2 inch through 1-1/2 inches, 1 inch for risers 2 inches and larger.

4. Body: Copper alloy.

5. Ball: Chrome-plated brass.

6. Seats and Seals: Replaceable.

7. Handle: Vinyl-covered steel.

8. Inlet: Threaded.

9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves.

2. Pressure Rating: 200-psigminimum CWP or Class 125.

3. Size: NPS 3/4.

4. Body: Copper alloy or ASTM B 62 bronze.

5. Drain: NPS 1/8side outlet with cap.

2.4 WATER HAMMER ARRESTERS

A. Water Hammer Arresters (**WHA**):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. JR Smith Mfg. Co.

b. Sioux Chief Manufacturing Company, Inc.

c. PPP Inc.

d. Watts Drainage Products Inc.

2. Basis of Design: JR Smith Figure #5201-5250 lead-free.

3. Standard: ASSE 1010 or PDI-WH 201.

4. Type: Piston type

5. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.5 OUTLET BOXES

B. Icemaker Outlet Boxes **(OB-1)**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company.

b. IPS Corporation.

c. Oatey.

d. Sioux Chief.

2. Basis of Design: Oatey #39140 with arrester.

3. Mounting: Recessed.

4. Material and Finish: Powder coated box and faceplate mount at 60 inches AFF to centerline unless noted otherwise on plans.

5. Supply Shutoff Fitting: NPS 1/4 ball valve and NPS 1/4 copper supply water tubing. **Note:** Neatly coil 8 ft of tubing to allow equipment access/removal. Plastic piping will not be allowed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3. **Do not** install bypass piping around backflow preventers.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install Y-pattern strainers for water on supply side of each device where indicated on the Drawings.

E. Install draining-type post hydrants if/where indicated on plans. Connect, extend and terminate 1/4 inch drain as indicated on the Drawings.

F. Install water hammer arresters in water piping according to PDI-WH 201.

G. Install manual air vents at high points of water piping.

H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.

2. Calibrated balancing valves.

3. Thermostatic, water mixing valves.

4. Supply-type, trap-seal primer valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following for soil, waste, vent and sub soil drainage piping inside the building and indicated on plans to a point 5’-0” beyond exterior wall or as noted on plans.

1. Pipe, tube, and fittings.

2. Special pipe fittings.

3. Encasement for underground metal piping.

4. Indirect waste pipe and fittings

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. LLDPE: Linear, low-density polyethylene plastic.

D. NBR: Acrylonitrile-butadiene rubber.

E. PE: Polyethylene plastic.

F. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to Division 22 Section 22 048 "Seismic Protection."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings and specialty fittings, couplings, primer and solvent.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. All cast iron pipe and fittings shall be manufactured in the **U.S.A.** and marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International. All cast-iron pipe and fittings shall be by the same manufacturer.

C. Foreign manufactured or imported pipe or fittings will **not** be allowed.

D. PVC DWV pipe and fittings **shall not** be installed in return air plenum space. Refer to HVAC plans for return air plenum space. Contact engineer, in writing, if unclear where return air plenums are located. This Contractor shall submit scaled plans, to the Engineer prior to fabrication or installation, for review indicating his understanding of return air plenum spaces

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste 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 service according to requirements indicated:

1. Notify Architect and Construction Manager no fewer than five days in advance of proposed interruption of sanitary waste service.

2. Do not proceed with interruption of sanitary waste service without Architect's and Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

a. Charlotte Pipe and Foundry.

b. AB&I Foundry.

c. Tyler Pipe.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS (Interior Below Slab and/or **Only** where indicated on plans)

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS (Interior above slab and only in return air plenums.) Note: Hubless cast-iron pipe and fittings will not be allowed under slab.

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 and ASTM C 1540 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop, UPC emblem

1. Heavy-Duty, Shielded, 304 Stainless Steel Couplings: With 304 corrugated stainless-steel shield, stainless-steel bands and slotted tightening devices, and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) ANACO.

2) Ideal Div.; Stant Corp.

3) Mission Rubber Co.

4) Tyler Pipe; Soil Pipe Div.

2. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with 304 stainless-steel corrugated shield; 304 stainless-steel bands and slotted tightening devices; and ASTM C 564, rubber sleeve & bear the NSF Trademark.

a. Manufacturers:

1) ANACO

2) Mission Rubber Co.

3) Tyler Pipe: Soil Pipe Div.

2.5 SPECIALTY PIPE FITTINGS

C. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Shielded, Non-pressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Fernco Inc.

2) Cascade Waterworks Mfg. Co.

3) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460

c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, **soil, waste and vent** piping NPS 2and smaller shall be the following:

1. Hubless cast-iron soil pipe and fittings; standard shielded, stainless-steel couplings; and

hubless-coupling joints.

C. Aboveground, **soil and waste** piping NPS 3and larger shall be the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

D. Aboveground, **vent** piping NPS 4and smaller shall be the following:

1. Hubless cast-iron soil pipe and fittings; standard shielded, stainless-steel couplings; and hubless-coupling joints.

E. Aboveground, **vent** piping NPS 6and larger shall be the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

3.3 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

F. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is

prohibited.

I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3and smaller; 1 percent downward in direction of flow for piping NPS 4and larger.

2. Vent Piping: 1/2 percent down toward vertical fixture vent or toward vent stack.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Do not enclose, cover, or put piping into operation until it is inspected and approved in writing by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

D. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.

2. Install individual, straight, horizontal piping runs according to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer than 100 Feet MSS Type 43, adjustable roller hangers.

c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inchminimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 260 inches with 3/8-inch rod.

2. NPS 360 inches with 1/2-inch rod.

3. NPS 4 and NPS 560 inches with 5/8-inch rod.

4. NPS 660 inches with 3/4-inch rod.

5. NPS 8 to NPS 1260 inches with 7/8-inch rod.

G. Install supports for vertical cast-iron soil piping every 15 feet

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

2. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2and larger.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Through-penetration firestop assemblies.
4. Miscellaneous sanitary drainage piping specialties.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product specified, additionally include rated capacities, operating characteristics, and accessories.

B. Manufacturer Seismic Qualification Certification: Submit certification that grease interceptors, accessories, and components will withstand seismic forces defined in Division 22 Section "Seismic Protection." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. 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.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

D. Source Limitations: Obtain sanitary specialties and other components of each category through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Stack Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

b. Watts Drainage Products Inc.

c. Zurn Plumbing Products Group.

2. Standard: ASME A112.36.2M for cast-iron for cleanout test tee.

3. Size: Same as connected drainage piping

4. Body Material: Match connected piping.

5. Closure: Countersunk or raised-head cast-iron plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Closure: Stainless-steel plug with seal.

B. Floor Cleanouts (FCO):

1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

b. Watts Drainage Products Inc.

c. Zurn Plumbing Products Group.

2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.

3. Size: Same as connected branch.

4. Type: Cast-iron soil pipe with cast-iron ferrule.

5. Body or Ferrule: PVC, Cast iron or Stainless steel.

6. Clamping Device: Not required.

7. Outlet Connection: Inside calk or Spigot.

8. Closure: Cast-iron plug.

9. Adjustable Housing Material: PVC or Cast-iron with set-screws or other device.

10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.

11. Frame and Cover Shape: Round, scoriated.

12. Top Loading Classification: Heavy Duty.

13. Riser: Schedule 40 PVC drainage pipe fitting and riser to cleanout.

14. Standard: ASME A112.3.1.

15. Size: Same as connected branch.

16. Standard: ASME A112.3.1.

17. Basis of Design: Zurn CO 2449 adjustable.

C. Wall Cleanouts (**WCO**):

1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

    a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

    b. Watts Drainage Products Inc.

    c. Zurn Plumbing Products Group.

2. Standard: ASME A112.36.2M. Include wall access.

3. Size: Same as connected drainage piping.

4. Body: Hub-and-spigot, cast-iron soil pipe T-branch, hubless cast-iron soil pipe or PVC test tee as required to match connected piping.

5. Closure: Countersunk or raised-head plug. One style shall be used for the entire project.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with vandal proof screw.

2.2 FLOOR DRAINS

A. Floor Drains (**FD**):

1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

    a. Smith, Jay R Mfg. Co.; Division of Smith Industries.

    b. Zurn Plumbing Products Group; Specification Drainage Operation.

    c. Watts Drainage Products Inc.

2. Standard: ASME A112.6.3.

3. Pattern: Floor drain.

4. Body Material: Gray iron.

5. Seepage Flange: Required.

6. Anchor Flange: Required.

7. Clamping Device: Required.

8. Outlet: Bottom.

9. Backwater Valve: Provide trap guard.

10. Coating on Interior and Exposed Exterior Surfaces: Not required.

11. Sediment Bucket: Refer to schedule on plans.

12. Top or Strainer Material: Refer to schedule on plans.

13. Top of Body and Strainer Finish: Nickel bronze.

14. Top Shape: Square.

15. Top Loading Classification: heavy-duty

16. Funnel: Refer to schedule on plans.

17. Inlet Fitting:

18. Trap: Deep seal trap material: Cast-iron

19. Refer to schedule on plans.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ProSet Systems Inc.

   b. Metacaulk.

   c. 3M – Fire Protection Products.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.

3. Size: Same as connected soil, waste, or vent stack.

4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.

6. Special Coating: Corrosion resistant on interior of fittings.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Schedule 40 DWV PVC, Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout connection.

2. Size: Same as connected waste piping.

a. NPS 24-inch-minimum water seal.

b. NPS 2-1/2and Larger: 5-inch-minimum water seal.

B. Floor-Drain, trap seal:

1. Provide trap guard.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.

2. Size: As required for close fit to riser or stacks piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

2. Size: Same as connected stack vent or vent stack.

E. Expansion Joints:

1. Standard: ASME A112.21.2M.

2. Body: Cast iron with bronze sleeve, packing, and gland.

3. End Connections: Matching connected piping.

4. Size: Same as connected soil, waste, or vent piping.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft.0.0625-inchthickness.

2. Vent Pipe Flashing: 3.0-lb/sq. ft.0.0469-inchthickness.

3. Burning: 6-lb/sq. ft.0.0938-inchthickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft.

2. Vent Pipe Flashing: 8 oz./sq. ft.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inchminimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-milminimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping where indicated on plans. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4Use NPS 4for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4and smaller and 100 feet for larger piping.

4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.

2. 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-inchtotal depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

J. Install expansion joints on vertical stacks and conductors where noted on plans Position expansion joints for easy access and maintenance.

K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within

cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 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. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

PART 1 - GENERAL

1.1 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 conventional plumbing fixtures and related components:

1. Water closets.
2. Toilet seats.
3. Flushometers.
4. Lavatories.
5. Faucets for lavatories.
6. Individual showers.
7. Commercial Sinks.
8. Commercial Integrated Countertop with Sinks.
9. Faucets for Commercial Sinks.
10. Mop Basins.
11. Faucets for Mob basins.
12. Fixture supports.
13. Fixture Service Stops.
14. Fixture Drains, Traps, tail pieces, and strainers
15. Owner-furnished fixtures.
16. Fixtures supplied by others.
17. Supply and trap insulating kits.

B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties" for specialty fixtures not included in this Section.
3. Division 22 Section “Plumbing Insulation” for insulation requirements.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. ADA Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps, waste and indirect waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass-reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

J. LF: Lead Free

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For all plumbing fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. 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.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities**;** Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water. Comply with Reduction of Lead in Drinking Water Act “Lead Free Law”.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. All vitreous china fixture trap ways shall be fully glazed internally.

H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
   1. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
   2. Stainless-Steel Commercial, Hand wash Sinks: NSF 2 construction.
   3. Vitreous-China Fixtures: ASME A112.19.2M.
   4. Water-Closet, Flush Valve: ASME A112.19.5.

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

   1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
   2. Faucets: ASME A112.18.1.
   3. Hose-Connection Vacuum Breakers: ASSE 1011.
   4. Hose-Coupling Threads: ASME B1.20.7.
   5. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
   6. NSF Potable-Water Materials: NSF 61.
   7. Pipe Threads: ASME B1.20.1.
   8. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
   9. Supply Fittings: ASME A112.18.1.
   10. Brass Waste Fittings: ASME A112.18.2.
   11. Trap and Supply Insulation: ANSI A117.1.
   12. Federal “Reduction of Lead in Drinking Water Act” – 2011.

J. Comply with the following applicable standards and other requirements specified for shower faucets:

   1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
   2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
   3. Faucets: ASME A112.18.1.
   4. Hand-Held Showers: ASSE 1014.
   5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
   6. Hose-Coupling Threads: ASME B1.20.7.
   7. Manual-Control Anti-scald Faucets: ASTM F 444.
   8. Pipe Threads: ASME B1.20.1.
   9. Pressure-Equalizing-Control Anti-scald Faucets: ASTM F 444 and ASSE 1016.
   10. Thermostatic-Control Anti-scald Faucets: ASTM F 444 and ASSE 1016.

K. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

   1. Atmospheric Vacuum Breakers: ASSE 1001.
   2. Brass and Copper Supplies: ASME A112.18.1.
   3. Manual-Operation Flushometers: ASSE 1037.
   4. Brass Waste Fittings: ASME A112.18.2.

L. Comply with the following applicable standards and other requirements specified for

miscellaneous components:

1. Floor Drains: ASME A112.6.3.
2. Pipe Threads: ASME B1.20.1.
3. Plastic Toilet Seats: ANSI Z124.5.
4. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 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. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
2. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 5 of each type.
3. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
4. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. WATER CLOSETS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Kohler.
b. American Standard.
c. TOTO USA, Inc.

B. WATER CLOSET SEATS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bemis Manufacturing Company.
b. Centoco Manufacturing Corp.
c. Olsonite Manufacturing.

C. FLUSHOMETERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Sloan Valve Company.
b. American Standard.
c. Kohler.

D. LAVATORIES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Kohler.
   b. American Standard.
   c. TOTO USA, Inc.

E. LAVATORY FAUCETS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Delta Faucet Company.
   b. Moen.
   c. Chicago Faucets.

F. SHOWER VALVES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Chicago Faucets.
   b. Delta Faucet Company.
   c. Symmons Industries, Inc.

G. COMMERCIAL SINKS – STAINLESS STEEL

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkay Manufacturing Co.
   b. Just Manufacturing Company.
   c. Amtekco, a Wasserstrom Company.

H. COMMERCIAL INTEGRATED COUNTERTOP WITH SINK – STAINLESS STEEL

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Just Manufacturing Company.
   b. Advance Tabco
   c. Elkay
   d. Just Sinks

I. SINK FAUCETS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Delta Faucet Company.
   b. Moen.
   c. Chicago Faucets.

J. MOP BASINS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Crane Plumbing, LLC, Fiat Products.
   b. E.L. Mustee.
   c. Florestone Products Co., Inc.

K. MOP BASIN FAUCETS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Delta Faucet Company.
   b. Moen.
   c. Chicago Faucets.

L. FIXTURE SUPPLIES, STOPS

1. Manufacturers: Subject to compliance with requirements, provide lead-free products by one of the following:

   a. McGuire Manufacturing Co., Inc.
   b. Fluidyne Ansonia.
   c. BrassCraft.

M. FIXTURE DRAINS, TRAPS, TAILPIECES AND STRAINERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Dearborn Brass
   b. McGuire Manufacturing Co., Inc.
   c. Brasscraft.

N. SUPPLY AND TRAP INSULATING KITS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Truebro, IPS Corporation.
   b. Pro-wrap, McGuire Manufacturing Co., Inc.
   c. Plumberex Specialty Products.

O. FIXTURE SUPPORTS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.

b. Tyler Pipe; Wade Div.
c. Zurn.

2.2 FIXTURES

All Manufacturer's and Models listed are Basis of Design:

A. **WC-1** Water Closet – Floor Set – ADA

1. Fixture: Kohler # K-4405 "HIGHLINE", 1.28 gpf, white, bolt caps.
2. Seat: Kohler # 4371-SA-0, open-front, white, antimicrobial.
3. Valve: Kohler # K-13517-RF-CP, piston, chrome plated finish.

B. **LA-1** Lavatory – Wall Hung

1. Fixture: Kohler # K-2005 "KINGSTON", white, wall hung.
2. Faucet: Chicago Faucet # 895-317CP with #E29VPJKCP laminar flow outlet.
3. Drain: McGuire # 155A, chrome plated, open grid, 1 1/4" x 6", 17 gauge, seamless brass.
4. Trap: Dearborn # 707DF-1, 1 1/4", 17 gauge, cast-brass "P" trap w/CO plug and escutcheon.
5. Supplies: McGuire # LF-2165LK, loose key, riser length as required.
6. Note: Caulk edges of basin in contact with wall using white silicone caulking.
7. Drain, Trap and Supply Insulation Kit: Truebro Lav Guard 2, white.
8. **Note:** ADA Mounting Height – refer to Architectural plans.

C. **SH-1** Shower –ADA

1. Fixture: Refer to Architectural plans and specifications for enclosure.
2. Valve: Symmons Industries, Inc. #C-96-500-B30-V-X-VP.
3. Drain: 2 inch FD-1.
4. Note: Furnish and install backing behind shower head inlet to prevent movement, Sioux Chief # 616-2E.
5. Detail: Refer to detail on plan for mounting heights.
6. Insulation Kit: Truebro Lav Guard 2, white.

D. **SK-1** Sink – Double Bowl – ADA Compliant

1. Fixture: Elkay MFG. Co. # LR3722, self-rimming, 3 hole.
2. Faucet: Chicago Faucet # 895-317GN8AE29VPCP.
3. Strainer: Elkay Mfg. Co. # LK-99. (2 required).
4. Trap: Dearborn # 710DF-1, 1-1/2", 17 gauge, cast-brass "P" trap with CO plug and escutcheon.
5. Waste: Dearborn #111A-1, 1-1/2", 17 gauge cast-brass.
6. Supplies: McGuire # BV2165, loose key, riser length as required.

E. **SK-2** Countertop with Integral Sink – Double Bowl

1. Fixture: Just Manufacturing – Custom, see schedule on plans for details.

2. Faucet: Chicago Faucet # 895-317GN8AE29VPCP.
3. Strainer: Elkay Mfg. Co. # LK-99. (2 required).
4. Trap: Dearborn # 710DF-1, 1-1/2", 17 gauge, cast-brass "P" trap with CO plug and escutcheon.
5. Waste: Dearborn #111A-1, 1-1/2", 17 gauge cast-brass.
6. Supplies: McGuire # BV2165, loose key, riser length as required.

F. **MSB-1** Mop Sink Basin

1. Fixture: Fiat Products # TSB3003.
2. Faucet: Fiat Products # 830-AA, centerline of inlets at 36" AFF.
3. Mop hanger: Fiat Products # 889-CC, centerline of hanger at 60" AFF.
4. Hose and bracket: Fiat Products # 832-AA, centerline of bracket at 18" AFF.
5. Wall guard: Fiat Products # MSG-2424.
6. Silicone Sealant: Fiat Products # 833-AA, use where basin is in contact with wall.

2.3 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

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

2.4 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use lead-free ball valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

L. Install toilet seats on water closets.

M. Install shower flow-control fittings with specified maximum flow rates in shower arms.

N. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

O. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

P. Set shower receptors and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

Q. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

2.5 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Connect owner furnished fixtures and equipment per manufacturer’s requirements and as noted on the plans.

D. Connect food service equipment per food service equipment manufacturer’s requirements and as noted on the plans. Furnish and install drains, traps, loose-key supplies, risers, indirect wastes,

etc. not provided with food service equipment. All drains, traps and indirect wastes shall be 17 gauge, chrome plated cast brass and traps shall have CO plugs.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

2.6 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing equipment and fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

2.7 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Clean all aerators and flow screens.

D. Replace washers and seals of leaking and dripping faucets and supply stops.

2.8 CLEANING

A. Clean fixtures, faucets, drains and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains and drain bodies.
3. Clean all roof, floor drain and floor sink grates.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

2.9 PROTECTION

A. Provide protective covering during construction for all installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions

and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.

2. Dielectric fittings.

3. Mechanical sleeve seals.

4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are

concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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 manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Eslon Thermoplastics.

b. Spears

c. Westlake

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Thompson Plastics, Inc.

b. Eslon Thermoplastics.

c. Spears

d. Westlake

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Available Manufacturers:

a. NIBCO INC.

b. NIBCO, Inc.; Chemtrol Div.

c. Thompson Plastics, Inc.

d. Eslon Thermoplastics.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Available Manufacturers:

a. Capitol Manufacturing Co.

b. Central Plastics Company.

c. Eclipse, Inc.

d. Epco Sales, Inc.

e. Hart Industries, International, Inc.

f. Watts Industries, Inc.; Water Products Div.

g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Capitol Manufacturing Co.

b. Central Plastics Company.

c. Eclipse, Inc.

d. Epco Sales, Inc.

e. Hart Industries, International, Inc.

f. Watts Industries, Inc.; Water Products Div.

g. Zurn Industries, Inc.; Wilkins Div.

E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Perfection Corp.

b. Precision Plumbing Products, Inc.

c. Sioux Chief Manufacturing Co., Inc.

d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Metraflex Co.

d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Stainless Steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. One-piece, stamped-steel type with spring clips.

1. Finish: Polished chrome-plated.

E. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Insulated Piping: One-piece, stamped-steel type with spring clips.

c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.

d. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

e. Bare Piping in Equipment Rooms: One-piece, cast-brass type.

f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required

for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. 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. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 230500

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

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. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.
7. Sight flow indicators.
8. Orifice flowmeters.
9. Pitot-tube flowmeters.

1.3 ACTION SUBMITTALS

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

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

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. Trerice, H. O. Co.

b. Weiss Instruments

c. Weksler

2. Standard: ASME B40.200.

3. Case: Cast aluminum; 6-inch (152-mm) nominal size.

4. Tube: Glass with magnifying lens and blue or red organic liquid.

5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.

6. Window: Glass or plastic.

7. Stem: Aluminum or brass and of length to suit installation.

a. Design for Air-Duct Installation: With ventilated shroud.

b. Design for Thermowell Installation: Bare stem.

8. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.

9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.

2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.

3. Material for Use with Copper Tubing: CNR or CUNI

4. Material for Use with Steel Piping: CRES

5. Type: Stepped shank unless straight or tapered shank is indicated.

6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.

7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.

8. Bore: Diameter required to match thermometer bulb or stem.

9. Insertion Length: Length required to match thermometer bulb or stem.

10. Lagging Extension: Include on thermowells for insulated piping and tubing.

11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

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. AMETEK, Inc.; U.S. Gauge.

b. Ashcroft Inc.

c. Ernst Flow Industries.

d. Flo Fab Inc.

e. Marsh Bellofram.

f. Miljoco Corporation.

g. Noshok.

h. Palmer Wahl Instrumentation Group.

i. REOTEMP Instrument Corporation.

j. Tel-Tru Manufacturing Company.

k. Trerice, H. O. Co.

l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.

m. Weiss Instruments, Inc.

n. WIKA Instrument Corporation - USA.

o. Winters Instruments - U.S.

2. Standard: ASME B40.100.

3. Case: Sealed 4-1/2-inch (114-mm) nominal diameter.

4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

5. Pressure Connection: Brass, with NPS 1/4 (DN 8) ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

6. Movement: Mechanical, with link to pressure element and connection to pointer.

7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.

8. Pointer: Dark-colored metal.

9. Window: Glass or plastic

10. Ring: Metal.

11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS ¼ (DN 8), ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 (DN 8) ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

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

1. Flow Design, Inc.

2. Miljoco Corporation.

3. National Meter, Inc.

4. Peterson Equipment Co., Inc.

5. Sisco Manufacturing Company, Inc.

6. Trerice, H. O. Co.

7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.

8. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 (DN 8) or NPS 1/2 (DN 15), ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.7 TEST-PLUG KITS

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

1. Flow Design, Inc.

2. Miljoco Corporation.

3. National Meter, Inc.

4. Peterson Equipment Co., Inc.

5. Sisco Manufacturing Company, Inc.

6. Trerice, H. O. Co.

7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.

8. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).

E. Carrying Case: Metal or plastic, with formed instrument padding.

2.8 SIGHT FLOW INDICATORS

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

1. Archon Industries, Inc.

2. Dwyer Instruments, Inc.

3. Emerson Process Management; Brooks Instrument.

4. Ernst Co., John C., Inc.

5. Ernst Flow Industries.

6. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.

7. OPW Engineered Systems; a Dover company.

8. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 125 psig (860 kPa).

E. Minimum Temperature Rating: 200 deg F (93 deg C).

F. End Connections for NPS 2 (DN 50) and Smaller: Threaded.

G. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.

2.9 FLOWMETERS

A. Orifice Flowmeters:

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. ABB; Instrumentation and Analytical.

    b. Bell & Gossett; ITT Industries.

    c. Meriam Process Technologies.

    d. Preso Meters; a division of Racine Federated Inc.

    e. S. A. Armstrong Limited; Armstrong Pumps Inc.

2. Description: Flowmeter with sensor, hoses or tubing, fittings, valves, indicator, and conversion chart.

3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.

4. Sensor: Wafer-orifice-type, calibrated, flow-measuring element; for installation between pipe flanges.

    a. Design: Differential-pressure-type measurement for water.

    b. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.

    c. Minimum Pressure Rating: 300 psig (2070 kPa) Minimum Temperature Rating: 250 deg F (121 deg C).

5. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected sensor and having 6-inch- (152-mm-) diameter, or equivalent, dial with fittings and copper tubing for connecting to sensor.

    a. Scale: Gallons per minute (Liters per second).

    b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.

6. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected sensor and having two 12-foot (3.7-m) hoses, with carrying case.

    a. Scale: Gallons per minute (Liters per second).

    b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.

7. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).

8. Conversion Chart: Flow rate data compatible with sensor and indicator.

9. Operating Instructions: Include complete instructions with each flowmeter.

B. Pitot-Tube Flowmeters:

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. ABB; Instrumentation and Analytical.

   b. Emerson Process Management; Rosemount.

   c. Meriam Process Technologies.

   d. Preso Meters; a division of Racine Federated Inc.

   e. TACO Incorporated.

   f. Veris Industries, Inc.

2. Description: Flowmeter with sensor and indicator.

3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.

4. Sensor: Insertion type; for inserting probe into piping and measuring flow directly in gallons per minute (liters per second).

   a. Design: Differential-pressure-type measurement for water.

   b. Construction: Stainless-steel probe of length to span inside of pipe, with integral transmitter and direct-reading scale.

   c. Minimum Pressure Rating: 150 psig (1035 kPa).

   d. Minimum Temperature Rating: 250 deg F (121 deg C).

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.

6. Integral Transformer: For low-voltage power connection.

7. Accuracy: Plus or minus 3 percent.

8. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).

9. Operating Instructions: Include complete instructions with each flowmeter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install remote-mounted pressure gages on panel.

J. Install valve and snubber in piping for each pressure gage for fluids (except steam).

K. Install valve and syphon fitting in piping for each pressure gage for steam.

L. Install test plugs in piping tees.

M. Install flow indicators in piping systems in accessible positions for easy viewing.

N. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

O. Install flowmeter elements in accessible positions in piping systems.

P. Install wafer-orifice flowmeter elements between pipe flanges.

Q. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

R. Install permanent indicators on walls or brackets in accessible and readable positions.

S. Install connection fittings in accessible locations for attachment to portable indicators.

T. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.

2. Inlet and outlet of each hydronic coil in air-handling units.

3. Outside-, return-, supply-, and mixed-air ducts.

U. Install pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic zone shall be the following:

1. Compact-style, liquid-in-glass type.

B. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be the following:

1. Compact style, liquid-in-glass type.

C. Thermometers at outside-, return-, supply-, and mixed-air ducts shall be the following:

1. Direct-mounted, metal or plastic-case, vapor-actuated type.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: Minus 40 to plus 160 deg F (Minus 40 to plus 100 deg C).

B. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).

C. Scale Range for Air Ducts: Minus 40 to plus 160 deg F (Minus 40 to plus 100 deg C).

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each pressure-reducing valve shall be the following:

1. Sealed, direct remote-mounted, plastic case.

B. Pressure gages at inlet and outlet of each chiller chilled-water connection shall be one of the following:

1. Sealed, direct -mounted, plastic case.

2. Test plug with EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 160 psi (0 to 1100 kPa).

B. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi (0 to 1100 kPa.

END OF SECTION 230519

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230548 "Vibration and Seismic Controls for HVAC"
3. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.

2. Metal framing systems.

3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.

2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: 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.

B. 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

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 inturned 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 Retain one of four subparagraphs below for coating.

6. Metallic Coating: Electroplated zinc or Hot-dipped galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

2. Standard: Comply with MFMA-4.

3. Channels: Continuous slotted steel channel with inturned 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

6. Coating: Zinc

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inchesbeyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

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.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. 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.

B. 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.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. 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.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. 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.

M. 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.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

b. NPS 4: 12 inches long and 0.06 inch thick.

c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

e. NPS 16 to NPS 24 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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.

3.3 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.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099123 "Interior Painting".

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. 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. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.

12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (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.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation 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-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.

    b. Medium (MSS Type 32): 1500 lb.

    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

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): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

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 and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

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. Elastomeric hangers.
2. Spring hangers.
3. Snubbers.
4. Restraint channel bracings.
5. Restraint cables.
6. Seismic-restraint accessories.
7. Mechanical anchor bolts.
8. Adhesive anchor bolts.
9. Restrained isolation roof-curb rails.

B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire Suppression" for devices for fire-suppression equipment and systems.
2. Section 220548 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.

b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic and wind forces required to select vibration isolators and seismic and wind restraints and for designing vibration isolation bases.

a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.

4. Seismic- and Wind-Restraint Details:

   a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.

   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

   c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

   d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

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

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are

preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.

2. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.

   a. Component Importance Factor: 1.0.

   b. Component Response Modification Factor: 2.0.

   c. Component Amplification Factor: 2.5.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.504 g.

4. Design Spectral Response Acceleration at 1.0-Second Period: 0.234 g.

5. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

   a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.2 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

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. Ace Mountings Co., Inc.

   b. California Dynamics Corporation.

   c. Isolation Technology, Inc.

   d. Kinetics Noise Control, Inc.

   e. Mason Industries, Inc.

   f. Vibration Eliminator Co., Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.3 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

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. Ace Mountings Co., Inc.

b. California Dynamics Corporation.

c. Kinetics Noise Control, Inc.

d. Mason Industries, Inc.

e. Vibration Eliminator Co., Inc.

f. Vibration Isolation.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.4 SNUBBERS

A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.

2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.5 RESTRAINT CABLES

A. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.6 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.7 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.8 ADHESIVE ANCHOR BOLTS

A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide

anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

D. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

E. Piping Restraints:

1. Comply with requirements in MSS SP-127.

2. Space lateral supports a maximum of 40 feeto.c., and longitudinal supports a maximum of 80 feeto.c.

3. Brace a change of direction longer than 12 feet.

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

K. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

6. Measure isolator restraint clearance.

7. Measure isolator deflection.

8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.7 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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. Equipment labels.

2. Pipe labels.

3. Duct Labels

1.3 ACTION SUBMITTALS

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

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches , and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

1. For rooftop units and air handling units include design supply airflow.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches.

2.3 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

E. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

F. Fasteners: Stainless-steel rivets or self-tapping screws.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Section 099101 "Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

D. Pipe Label Color Schedule:

1. Chilled-Water Piping:

a. Background color: Green.

b. Letter color: White.

2. Heating Water Piping:

a. Background color: Green.

b. Letter color: White.

3.5 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.

2. Yellow: For hot-air supply ducts.

3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

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. Balancing Air Systems:

a. Constant-volume air systems.

b. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:

a. Constant-flow hydronic systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Instrument calibration reports, to include the following:

1. Instrument type and make.

2. Serial number.

3. Application.

4. Dates of use.

5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or TABB.

2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or TABB as a TAB technician.

B. TAB Conference: Meet with Architect on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.

b. The TAB plan.

c. Coordination and cooperation of trades and subcontractors.

d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2010, Section 7.2.2 - "Air Balancing."

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2010, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

PART 2 - Products (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes 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.

8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in ASHRAE 111 and in this Section.

1. Comply with requirements in ASHRAE 62.1-2010, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230700 "Mechanical Insulation."

C. 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.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 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.

b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. 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.

d. 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. Obtain approval from Architect for 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.

6. 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.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.

8. Record final fan-performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:

1. Check liquid level in expansion tank.

2. Check highest vent for adequate pressure.

3. Check flow-control valves for proper position.

4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

5. Verify that motor starters are equipped with properly sized thermal protection.

6. Check that air has been purged from the system.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.

1. Measure total water flow.

a. Position valves for full flow through coils.

b. Measure flow by main flow meter, if installed.

c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

2. Measure pump TDH as follows:

a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.

b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.

c. Convert pressure to head and correct for differences in gage heights.

d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.

e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow-measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.

2. Adjust main and branch balance valves for design flow.

3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow-measuring devices installed at terminals for each space to design water flows.

1. Measure flow at terminals.

2. Adjust each terminal to design flow.

3. Re-measure each terminal after it is adjusted.

4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.

5. Perform temperature tests after flows have been balanced.

D. For systems with pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.

2. Perform temperature tests after flows have been verified.

E. For systems without pressure-independent valves or flow-measuring devices at terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.

2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.

2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.

3. Mark final settings.

G. Verify that memory stops have been set.

3.9 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.

3.10 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 airflow 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 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.

3. Heating-Water Flow Rate: Plus or minus 10 percent.

4. Cooling-Water Flow Rate: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.12 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.

2. 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 specialist.

3. Project name.

4. Project location.

5. Architect's name and address.

6. Engineer's name and address.

7. Contractor's name and address.

8. Report date.

9. Signature of TAB supervisor who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:

a. Indicated versus final performance.

b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.

13. Data for terminal units, including manufacturer's name, type, size, and fittings.

14. Notes to explain why certain final data in the body of reports vary from indicated values.

15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.

    b. Conditions of filters.

    c. Cooling coil, wet- and dry-bulb conditions.

    d. Face and bypass damper settings at coils.

    e. Fan drive settings including settings and percentage of maximum pitch diameter.

    f. Inlet vane settings for variable-air-volume systems.

    g. Settings for supply-air, static-pressure controller.

    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.

2. Water and steam flow rates.

3. Duct, outlet, and inlet sizes.

4. Pipe and valve sizes and locations.

5. Terminal units.

6. Balancing stations.

7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.

    b. Location.

c. Make and type.

d. Model number and unit size.

e. Manufacturer's serial number.

f. Unit arrangement and class.

g. Discharge arrangement.

h. Sheave make, size in inches, and bore.

i. Center-to-center dimensions of sheave and amount of adjustments in inches.

j. Number, make, and size of belts.

k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.

b. Horsepower and rpm.

c. Volts, phase, and hertz.

d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Discharge static pressure in inches wg.

e. Filter static-pressure differential in inches wg.

f. Preheat-coil static-pressure differential in inches wg.

g. Cooling-coil static-pressure differential in inches wg.

h. Heating-coil static-pressure differential in inches wg.

i. Outdoor airflow in cfm.

j. Return airflow in cfm.

k. Outdoor-air damper position.

l. Return-air damper position.

m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.

b. Location.

c. Coil type.

d. Number of rows.

e. Fin spacing in fins per inch o.c.

f. Make and model number.

g. Face area in sq. ft..

h. Tube size in NPS.

i. Tube and fin materials.

j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.

b. Average face velocity in fpm.

c. Air pressure drop in inches wg

d. Outdoor-air, wet- and dry-bulb temperatures in deg F.

e. Return-air, wet- and dry-bulb temperatures in deg F.

f. Entering-air, wet- and dry-bulb temperatures in deg F.

g. Leaving-air, wet- and dry-bulb temperatures in deg F.

h. Water flow rate in gpm.

i. Water pressure differential in feet of head or psig.

j. Entering-water temperature in deg F.

k. Leaving-water temperature in deg F.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Entering-air temperature in deg F.

c. Leaving-air temperature in deg F.

d. Air temperature differential in deg F.

e. Entering-air static pressure in inches wg.

f. Leaving-air static pressure in inches wg.

g. Air static-pressure differential in inches wg.

h. High-temperature-limit setting in deg F.

i. Operating set point in Btu/h.

j. Motor voltage at each connection.

k. Motor amperage for each phase.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.

b. Location.

c. Coil identification.

d. Capacity in Btu/h.

e. Number of stages.

f. Connected volts, phase, and hertz.

g. Rated amperage.

h. Airflow rate in cfm.

i. Face area in sq. ft..

j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.

b. Airflow rate in cfm.

c. Air velocity in fpm.

d. Entering-air temperature in deg F.

e. Leaving-air temperature in deg F.

f. Voltage at each connection.

g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.

b. Location.

c. Make and type.

d. Model number and size.

e. Manufacturer's serial number.

f. Arrangement and class.

g. Sheave make, size in inches, and bore.

h. Center-to-center dimensions of sheave and amount of adjustments in inches.

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, and bore.

    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

    g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.

    b. Total system static pressure in inches wg.

    c. Fan rpm.

    d. Discharge static pressure in inches wg.

    e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling-unit number.

    b. Location and zone.

    c. Traverse air temperature in deg F.

    d. Duct static pressure in inches wg.

    e. Duct size in inches.

    f. Duct area in sq. ft.

    g. Indicated airflow rate in cfm.

    h. Indicated velocity in fpm.

i. Actual airflow rate in cfm.

j. Actual average velocity in fpm.

k. Barometric pressure in psig

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.

b. Location and zone.

c. Apparatus used for test.

d. Area served.

e. Make.

f. Number from system diagram.

g. Type and model number.

h. Size.

i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.

b. Air velocity in fpm.

c. Preliminary airflow rate as needed in cfm.

d. Preliminary velocity as needed in fpm.

e. Final airflow rate in cfm.

f. Final velocity in fpm.

g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.

b. Location and zone.

c. Room or riser served.

d. Coil make and size.

e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.

b. Entering-water temperature in deg F.

c. Leaving-water temperature in deg F.

d. Water pressure drop in feet of head or psig.

e. Entering-air temperature in deg F.

f. Leaving-air temperature in deg F.

L. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.

c. Application.

d. Dates of use.

e. Dates of calibration.

3.14 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.

B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

3. If the second verification also fails, Owner or Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.15 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

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. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.
6. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and 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.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Sealants and gaskets.

2. Seismic-restraint devices.

B. Delegated-Design Submittal:

1. Sheet metal thicknesses-All ductwork shall be a minimum of 24 gage.

2. Joint and seam construction and sealing.

3. Reinforcement details and spacing.

4. Materials, fabrication, assembly, and spacing of hangers and supports.

5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports, AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports and AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2010, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2010, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

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

a. Lindab Inc.

b. McGill AirFlow LLC.

c. SEMCO Incorporated.

d. Sheet Metal Connectors, Inc.

e. Spiral Manufacturing Co., Inc.

B. 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."

C. 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."

D. 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."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.

2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

2. Tape Width: 4 inches.

3. Sealant: Modified styrene acrylic.

4. Water resistant.

5. Mold and mildew resistant.

6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

7. Service: Indoor and outdoor.

8. Service Temperature: Minus 40 to plus 200 deg F.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

10. 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).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.

3. Shore A Hardness: Minimum 20.

4. Water resistant.

5. Mold and mildew resistant.

6. VOC: Maximum 75 g/L (less water).

7. Maximum Static-Pressure Class: 10-inch wg , positive and negative.

8. Service: Indoor or outdoor.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Base: Synthetic rubber resin.

3. Solvent: Toluene and heptane.

4. Solids Content: Minimum 60 percent.

5. Shore A Hardness: Minimum 60.

6. Water resistant.

7. Mold and mildew resistant.

8. 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).

9. VOC: Maximum 395 g/L.

10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.

11. Service: Indoor or outdoor.

12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.

2. Type: S.

3. Grade: NS.

4. Class: 25.

5. Use: O.

6. 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).

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.

2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments (training tower and apparatus bay): Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 , "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.6 SEISMIC-RESTRAINT DEVICES

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

1. Cooper B-Line, Inc.; a division of Cooper Industries.

2. Ductmate Industries, Inc.

3. Hilti Corp.

4. Kinetics Noise Control.

5. Loos & Co.; Cableware Division.

6. Mason Industries.

7. TOLCO; a brand of NIBCO INC.

8. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 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 ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

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. Install ducts with a clearance of 1 inch , plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. 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 .

J. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

K. 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."

3.2 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.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Outdoor, Supply-Air Ducts: Seal Class A.

3. Outdoor, Exhaust Ducts: Seal Class A.

4. Outdoor, Return-Air Ducts: Seal Class A.

5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class A.

6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.

7. Unconditioned Space, Exhaust Ducts: Seal Class A.

8. Unconditioned Space, Return-Air Ducts: Seal Class A.

9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class A.

10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.

11. Conditioned Space, Exhaust Ducts: Seal Class A.

12. Conditioned Space, Return-Air Ducts: Seal Class A.

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.

5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 , "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

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 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7.

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.

5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

2. Test the following systems:

   a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Test for leaks before applying external insulation.

5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

   a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated duct. Patch insulation as recommended by manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.

5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.

7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Provide drainage and cleanup for wash-down procedures.

7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Exhaust ducts serving shower rooms from air device to main: Aluminum.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 2-inch wg.

b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Variable-Volume Air-Handling Units:

a. Pressure Class: Positive 3-inch wg.

b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 3-inch wg.

b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg.

b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Negative 2-inch wg.

b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Negative 2-inch wg.

b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.

b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.

b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.

b. Velocity 1000 to 1500 fpm : Conical tap.

c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233423 - HVAC POWER VENTILATORS

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. Utility set fans.
2. Centrifugal wall ventilators.
3. Ceiling-mounted ventilators.
4. In-line centrifugal fans.
5. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevation.

B. Operating Limits: Classify according to AMCA 99.

C. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

6. Roof curbs.

7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For unit hangars and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.

2. Ceiling suspension assembly members.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 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. Belts: One set(s) for each belt-driven unit.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL WALL VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Loren Cook Company.

3. Acme Engineering & Manufacturing Corporation.

4. Aerovent; a division of Twin City Fan Companies, Ltd.

5. PennBarry.

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

1. Resiliently mounted to housing.

2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

4. Pulleys: Cast-iron, adjustable-pitch motor pulley.

5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit.

3. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.

4. Wall Grille: Ring type for flush mounting.

5. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in wall sleeve; factory set to close when fan stops.

6. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

2.2 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Loren Cook Company.

3. American Coolair Corporation.

4. PennBarry.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Isolation: Rubber-in-shear vibration isolators.

2. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.3 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Loren Cook Company.

3. Acme Engineering & Manufacturing Corporation.

4. PennBarry.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, and inlet cone.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Companion Flanges: For inlet and outlet duct connections.

3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.4 PROPELLER FANS

A. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring, with baked-enamel finish coat applied after assembly.

B. Fan Wheels: Formed-steel blades riveted to heavy-gauge steel spider bolted to cast-iron hub.

C. Fan Drive: Direct: Direct-drive motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing

D. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

2.5 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.6 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

C. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Adjust belt tension.

6. Adjust damper linkages for proper damper operation.

7. Verify lubrication for bearings and other moving parts.

8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

10. Shut unit down and reconnect automatic temperature-control operators.

11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

SECTION 238216.14 - ELECTRIC-RESISTANCE AIR COILS

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 electric resistance air coils.

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 each air coil.

2. Include rated capacities, operating characteristics, and pressure drops for each air coil.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which coil location and ceiling-mounted access panels are shown and coordinated with each other.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. ASHRAE Compliance: Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

2.2 COILS

A. Testing Agency Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Coil Assembly: Comply with UL 1995.

C. Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium

D. High-Temperature Coil Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or casing.

1. Secondary Protection: Load-carrying, manually reset or manually replaceable, thermal cutouts; factory wired in series with each heater stage.

E. Frames: Galvanized-steel channel frame for slip-in mounting.

F. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:

1. Magnetic contactor.

2. Mercury contactor.

3. Toggle switches; one per step.

4. Step controller.

5. Time-delay relay.

6. Pilot lights; one per step.

7. Airflow proving switch.

G. Thermostats: Wall-mounted thermostats, with temperature range from 50 to 90 deg F

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

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

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, operate electric coils to confirm proper unit operation.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Test air velocity across heater is minimum 600fpm.

4. Test shutdown of exhaust fan and motorized louver closure when associated thermostat reaches low temperature shutdown temp designated on plans.

5. Test all controls meet sequencing as noted on plans.

B. Prepare test and inspection reports.

END OF SECTION 238216.14

SECTION 260519 - BUILDING WIRE AND CABLE

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. Wiring and connections as shown on drawings or specified including service, feeders, branch circuit power, lighting systems, fire alarm systems and other systems specified.

2. Wiring to starters or controllers when such are provided by others. Wiring to motors, when starters are provided by contractor including all disconnects.

3. Wiring for Site Lighting Fixtures

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.5 SUBMITTALS

A. Submittals for approval by the engineer are not required for this section. Unrequested submittals will not be processed or reviewed. **Non-requirement of submittals is not to be construed as an allowance for substitutions and does not relieve the contractor from full compliance with the plans and specifications.**

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Nationally Recognized Testing Laboratory as suitable for purpose specified and shown.

1.7 REFERENCES

A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern that work. In conflict between referenced standards and contract documents, notify Architect/Engineer immediately. Confirm notification in writing. Do not proceed with the work until the Architect/Engineer issues written instructions.

B. National Electrical Manufacturers Association (NEMA):

1. WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

2. WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of electrical Energy.

3. WC 7 - Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of electrical Energy.

C. National Fire Protection Association (NFPA): NFPA 70 - National electrical Code.

D. Manufacturers' Catalogs: Specified manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein full.

1.8 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions. Include wire and cable lengths within 10 feet of length shown.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing, lengths and cable required.

1.9 COORDINATION

A. Coordinate Work under provisions of General Conditions.

B. Determine required separation between cable and other work.

C. Determine cable routing to avoid interference with other work.

D. Coordinate work with all other Contractors.

E. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.

F. Determine connection locations and requirements with the supplying Contractor.

G. Sequence rough in of electrical connections to coordinate with installation schedule for equipment.

H. Sequence electrical connections to coordinate with start-up schedule for equipment.

I. Allow for locations within 15 feet of those shown on the Drawings without additional charges.

1.10 DELIVERY, STORAGE AND HANDLING:

A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials will not be acceptable for use.

B. Store materials on site in clean, dry storage area.

C. Handle all materials carefully to preclude damage. Material with damage insulation shall not be acceptable for use.

PART 2 - PRODUCTS

2.1 Acceptable MANUFACTURERS

A. General Cable Corporation

B. Southwire

C. American Insulated Wire Corp.

D. Senator Wire & Cable Company.

E. Okonite Company

F. Encore Wire Corp.

2.2 BUILDING WIRE

A. Thermoplastic insulated building wire: NEMA WC 5, UL-83 ICEA S-61-402 or S-66-524.

B. Feeders and branch circuits larger than 6 AWG: Copper, stranded conductor, 600 volt insulation (THHN/THWN).

C. Feeders and branch circuits 6 AWG and smaller: Copper conductor, 600-volt insulation THHN/THWN, 6 and 8 AWG stranded conductor, smaller than 8 AWG, stranded.

D. Control Circuits: Copper, stranded conductor, 600-volt insulation, THW, THHN/THWN.

2.3 JOINTS AND SPLICES

A. Make terminations, taps and splices with an indent type pressure connector with insulating cover for 8 AWG and smaller.

B. Instead of indent type connectors insulated spring compression connectors may be used for 10 AWG and smaller.

C. Use mechanical compression or bolted type connector for 6 AWG or larger. Cover connector with insulating type or heat shrinkable insulation equivalent to 150% conductor insulation.

2.4 WIRE PULLING LUBRICANT

A. Pulling lubricant shall listed by a nationally recognized testing laboratory, water-based, polymer solution. Lubricants containing waxes or soaps are not acceptable.

B. The lubricant shall be compatible with the cable insulation and shall not cause any premature deterioration of the insulating material. When use on high voltage cable, the lubricant shall not affect the volume resistivity of any semi-conducting jacket or insulation shield present.

C. Dried residue from lubricant shall not become tacky or gum-up. Cables shall remain pullable after lubricant has dried.

D. The lubricant shall be approved by the cable manufacturer for use with their cables.

E. Acceptable Manufacturers/Products:

1. American Colloid/Poly-X.

2. American Polywater/Polywater J.

3. ARNCO/Hydra-Lube.

4. Buchanan/Quick Slip.

5. Condux/Super-Lube.

6. Ideal/Aqua-Gel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire has been completed.

C. Verify that equipment is ready for electrical connection, wiring, and to be energized.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

B. Review Section 011000 Summary of Work prior to beginning construction.

3.3 WIRING METHODS

A. Unless indicated otherwise use only building wire, type THHN/THWN insulation, in raceway.

3.4 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Use conductor not smaller than 12 AWG for power circuits.

C. Use conductor not smaller than 14 AWG for control circuits.

D. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet unless indicated otherwise.

E. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet unless indicated otherwise.

F. Pull all conductors into raceway at same time.

G. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

H. Protect exposed cable from damage.

I. Use suitable cable fittings and connectors.

J. Neatly train and lace wiring inside boxes, equipment, and panelboards.

K. Clean conductor surfaces before installing lugs and connectors.

L. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

M. Place an equal number of conductors for each phase of a circuit in same raceway or cable.

N. Splice only in accessible junction, outlet boxes, cable tray or surface metal raceway.

O. Make conductor lengths for parallel circuits equal.

P. Branch circuits shall not share neutrals.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 260553.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.6 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.

C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.

D. Provide suitable strain relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

E. Install disconnect switches, controllers, control stations, and control devices as indicated.

F. Modify equipment control wiring with terminal block jumpers as indicated.

G. Provide interconnecting conduit and wiring between devices and equipment where indicated.

3.7 FIELD QUALITY CONTROL

A. Inspect wire for physical damage and proper connection.

B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

C. Verify continuity of each branch circuit conductor

END OF SECTION 260519

SECTION 260526 - GROUNDING & BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Grounding for feeders and branch circuiting.

2. Grounding of pool equipment in conformance with NEC 680-26.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with National Electric Code.

2. Comply with Public Authorities having jurisdiction.

B. Source Quality Control

1. The authority having jurisdiction will inspect the installation for compliance with governing codes.

1.4 REFERENCES Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work. In conflict between referenced standards and contract documents, notify Architect/Engineer immediately. Confirm notification in writing. Do not proceed with the work until the Architect/Engineer issues written instructions.

A. National Fire Protection Association (NFPA): NFPA 70 - National electrical Code (NEC).

B. All products listed and labeled by independent testing laboratory.

C. Manufacturers' Catalogs: Specification manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

D. ANSI C2 - National Electrical Safety code.

1.5 SUBMITTALS

A. Submittals are not required for this Specification section and will not be reviewed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wire:

1. Equipment grounding conductors shall be insulated unless otherwise noted. Insulation shall be 600-volt, same type as phase conductors, green in color.

B. Ground Rods: Copper-clad steel; ¾ inch diameter by 10 feet in length.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a separate equipment grounding conductor in feeders and branch circuits. Terminate each end on grounding lug, bus or busing.

B. Size all grounding conductors as indicated on the drawings.

C. Bond all raceways, cabinet enclosures, and noncurrent-carrying parts of equipment to grounding system. Bond raceways such that a continuous path for current flow is maintained.

D. Bond all grounding systems together. Size of bonding conductors shall be as indicated on the drawings but at least the size of the largest grounding electrode conductor.

3.2 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

3.3 POOL EQUIPMENT GROUNDING

A. See drawings for grounding details in pool areas.

END OF SECTION 260526

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 conduit and equipment supports and anchors and fasteners.

1.3 REFERENCES

A. NECA - National Contractors Association.

B. ANSI/NFPA 70 - National Electrical Code.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Independent Testing Laboratory as suitable for purpose specified and shown.

1.5 COORDINATION

A. Anchors provided in this section shall be coordinated with Section 260548 Vibration and Seismic Controls for Electrical System.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide adequate corrosion resistance.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

C. Anchors and Fasteners:

1. Concrete Structural Elements: Use precast insert system, expansion anchors, preset inserts. Do not use powder or gas actuated anchors.
2. Steel Structural Elements: Use beam clamps steel ramset fasteners. Spring steel fasteners are also acceptable.
3. Concrete Surfaces: Use preset inserts and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
5. Solid Masonry Walls: Use expansion anchors and preset inserts.

6. Sheet Metal: Use sheet metal screws.
7. Wood Elements: Use wood screws.

2.2 STEEL CHANNEL

A. Description: Galvanized, combine channels to provide adequate strength and stability to support equipment as indicated on plans.

B. Acceptable Manufacturers

1. GS Metals Corp.
2. B-Line B22
3. Caddy/Erico
4. Unistrut P-1000
5. Huskey HP-200
6. Kindorf B-901

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

C. **Do not use powder or gas actuated anchors**.

D. Do not drill or cut structural members to depths greater than that indicated on the drawings.

E. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

F. Install surface-mounted cabinets and panelboards with minimum of four anchors.

G. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION 260529

SECTION 260533 - CONDUIT

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:

1. Metal conduit.
2. Flexible metal conduit.
3. Liquidtight flexible metal conduit.
4. Electrical metallic tubing.
5. Nonmetal conduit.
6. Fittings and conduit bodies.
7. Identification of all conduits.
8. Seismic protection for conduits in accordance with Specification Section 260548.

1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

D. ANSI/NFPA 70 - National Electrical Code (2017).

E. NECA "Standard of Installation."

F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

G. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 SUBMITTALS

A. Submit shop drawings and product data.

B. Indicate material specifications, dimensions, capacities, and color coding.

C. Provide product data for conduit.

1.5 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70.

1.6 WARRANTY

A. To maintain any warranty for the roofing system, obtain approval for all roof penetrations, supports, and attachments from roofing system manufacturer. Submit this approval to the architect/engineer prior to installation of equipment on roof.

1.7 PROJECT RECORD DOCUMENTS

A. Accurately record actual routing of conduits larger than 2".

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Independent Testing Company as suitable for purpose specified and shown.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.10 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

1.10 COORDINATION

A. Coordinate Work under General Conditions.

B. Sequence work as indicated in 011000 Summary of Work.

C. Determine required separation between conduit and other work.

D. Determine conduit routing to avoid interference with other work.

E. Coordinate work with all other Contractors.

F. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.

G. Determine connection locations and requirements with the supplying Contractor.

H. Sequence rough in of electrical connections to coordinate with installation schedule for equipment.

I. Sequence electrical connections to coordinate with start-up schedule for equipment.

J. Allow for locations within 15 feet of those shown on the Drawings without additional charges.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Minimum Size: Size conduit for conductor type installed, 3/4 inch unless otherwise indicated on the drawings.

B. Underground Installations:

1. More than 10 feet from Foundation Wall Direct Buried: Use nonmetallic conduit. transition to galvanized rigid steel before passing through the exterior wall as indicated on the contract documents.

2. Under Slab on Grade: Use nonmetallic conduit. Provide rigid steel elbows below grade and extend rigid steel to 6 inches above. Minimum Size: 1 inch.

C. Outdoor Locations, Above Grade: Use rigid steel.

D. Wet and Damp Locations: Use rigid PVC.

F. Dry Locations: Use Electric Metallic tubing. In exposed areas of basement and lower level provided rigid steel to 6 inches above finished floor. Use flexible metal conduit for connection to light fixtures and equipment. Use flexible metal conduit or metal clad cable for connection to ceiling mounted light fixtures. This cable exceed 6 feet in length and shall be provided with a ground wire.

G. Connection to Equipment or Devices:

1. Wet and Damp Location: Liquid tight flexible metal conduit.

2. Dry Locations: Flexible metal conduit.

2.2 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC): Rigid steel.

C. Fittings and Conduit Bodies:

1. Comply with ANSI C80.4, ANSI/NEMA FB 1, threaded type.

2. Locknuts; steel or malleable iron.

3. Bushings; insulating or insulated throat type.

4. Couplings; threaded type. Set screw or indenter type not acceptable.

2.3 FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction.

B. Fittings: ANSI/NEMA FB 1.

1. Connectors; die-cast or malleable iron, threadless, squeeze clamp type for non-jacketed conduit.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction with PVC jacket.

B. Fittings: ANSI/NEMA FB 1.

1. Connections; steel or malleable iron compression type with insulated throat and "O" ring assembly for liquid tight conduit.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies:

1. Couplings and connectors; steel compression type. Set screw type are acceptable. Comply with ANSI/NEMA FB 1.

2.6 NONMETALLIC CONDUIT

A. Description: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.7 SEALING

A. Fire Seal:

1. Seal penetrations of fire-rated walls, floors or ceilings by raceways for compliance with NEC 2011 300.21. Fill void around raceway. Use heavy wall steel pipe sleeves, anchored to building construction and finished plumb with wall, ceiling or floor lines. Acceptable products:

a. Chase Technology - CTC, PR-855.

b. Dow Corning - Silicone RTV foam 3-6548.

c. Nelson - Flamesafe.

d. T & B - Flamesafe.

e. 3 M - Fire Barrier.

B. Thermal Seal:

1. Seal penetrations of thermally insulated equipment or rooms to prevent heat transfer. Exterior of raceway with fiberglass or other seal material compatible to equipment or room and approved by Architect/Engineer. Interior of raceway with duct sealing compound at entry to equipment or room.

C. Water Seal:

1. Seal penetrations of perimeter walls or floors below grade to prevent entry of water. Use materials compatible with wall or floor construction and approved by Architect/Engineer. Use premanufactured fittings as detailed on the drawings.

2. Seal penetrations of roof with flashings compatible with roof design and approved by Roofing System Manufacturer and Architect/Engineer.

2.8 SUPPORTING DEVICES

A. Suspended conduits less than 1 inch.

1. For exposed construction, attach conduits to building structural or provide strap type hangers supported from threaded rods. Hangers manufactured by Minerallac, Midwest Electric, Crouse-Hinds, T & B, B-Line, Caddy/Erico or GS Metals Corp.

2. For conduits suspended above ceilings, anchor to building structural. When span exceeds NEC 2011 limits, provide channel steel between framing members. Tie wiring of conduit to air ducts, or other piping not permitted. Plumber's perforated strap not

permitted. Do not attach conduit to ceiling support wires.

B. Suspended Conduit 1 inch or larger.

1. Attach to building structural or provide threaded rod with "U" type hangers for single conduit.

2. Attach to building structural or provide trapeze hanger assemblies with Unistrut P-1000, Husky HP-200, Kindorf B-901, B-Line B-22 or GS Metals Corp and threaded rod for two or more conduits. Anchor conduits to hanger assembly with split pipe clamps.

3. Anchor threaded rod to insets in concrete.

4. Provide Seismic Protection of suspended conduit in accordance with Specification Section 260548 – Vibration and Seismic Controls for Electrical Systems.

C. Surface Mounted Conduit:

1. Provide one-hole galvanized steel straps for conduits one inch or less manufactured by Appleton, Steel City, B-Line, RACO or GS Metals. Provide clampbacks on exterior walls below grade or in wet areas.

2. For conduit larger than one inch and all exterior surfaces, use malleable iron pipe straps.

3. For multiple conduits, provide channel anchored to wall with conduit attached to channel with split pipe clamps. Provide space for 25% additional conduits.

4. In pool equipment area use stainless steel or other corrosion resistant supporting straps and hardware.

2.9 INTERFERENCES

A. Coordinate work with other contractors so that interference between piping, equipment, structural and electrical work will be avoided.

B. When interference develops, Architect/Engineer will decide which equipment will be relocated; regardless of which apparatus was installed first.

2.10 INSTALLATION

A. Install conduit in accordance with manufacturer's instructions.

B. Pools, pool equipment and chemical storage/handling areas: Rigid PVC conduit and fittings. Use compatible PVC boxes, fittings and enclosures.

C. Support conduit using spring steel fasteners, coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

E. Fasten conduit supports to building structure and surfaces under provisions of Section 260529

and as indicated on the drawings.

F. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports

G. Do not attach conduit to ceiling support wires.

H. Arrange conduit to maintain headroom and present neat appearance.

I. Route conduit parallel and perpendicular to walls.

J. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

K. Maintain adequate clearance between conduit and piping.

L. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

M. Cut conduit square using saw or pipecutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

P. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Q. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch size.

R. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

S. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.

T. Provide suitable pull string in each empty conduit except sleeves and nipples.

U. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

V. Ground and bond conduit under provisions of Section 260526.

W. Identify conduit under provisions of Section 260553.

X. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.

2.11 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

C. Install conduit to preserve moisture barrier of partitions and other elements.

END OF SECTION 260533

SECTION 260535 - BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Wall and ceiling outlet boxes.

2. Pull and junction boxes.

1.3 REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. ANSI/NFPA 70 - National Electrical Code.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 SUBMITTALS

A. Submit shop drawings and product data.

B. Indicate material specifications, dimensions, capacities, and color coding.

C. Provide product data for all boxes.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Independent Testing Laboratory as suitable for purpose specified and shown.

1.5 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Include installation within 15 feet of location

shown.

C. Boxes, enclosures, and cabinets installed in wet locations shall be cast boxes for use in wet locations.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel. Gangable boxes will be accepted.

B. Cast Boxes: NEMA FB 1, Type FD, cast. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.2 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Use Surface-Mounted PVC in Wet Locations and Pool Equipment Room: NEMA 250, Type 4 flat-flanged, surface-mounted junction box.

1. Material: PVC.

2. Cover: Furnish with ground flange, neoprene gasket, and stainless-steel cover screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Size all junction boxes in accordance with the N.E.C.

C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. Install boxes to preserve fire resistance rating of partitions and other elements.

F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

G. Use flush mounting outlet boxes in finished areas.

H. Do not fasten boxes to ceiling support wires.

I. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

J. Use gang box where more than one device is mounted together. Do not use sectional box.

K. Use cast outlet box in exterior locations exposed to the weather and wet locations.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for products furnished under other sections.

B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

3.3 ADJUSTING

A. Install knockout closure in unused box opening.

END OF SECTION 260535

SECTION 260548 - VIBRATION & SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

1.3 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. NRTL: Nationally Recognized Testing Laboratory.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D
2. Assigned Seismic Use Group or Building Category as Defined in the IBC:
    a. Seismic Use Group: II
    b. In subparagraph below, retain Seismic Use Group or Building Category for Project structure from three classifications defined in the IBC.
    c. Component Importance Factor: 1.0

d. Component Response Modification Factor: See Structural plans

e. Component Amplification Factor: See Structural plans.

3. Design Spectral Response Acceleration at Short Period (0.2 Second): See Structural plans.

4. Design Spectral Response Acceleration at 1.0-second period: See Structural plans.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.

b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.

a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.

3. Field-fabricated supports.

4. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and

spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

1.6 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.

2. Amber/Booth Company, Inc.

3. California Dynamics Corporation.

4. Isolation Technology, Inc.

5. Kinetics Noise Control.

6. Mason Industries.

7. Vibration Eliminator Co., Inc.

8. Vibration Isolation.

9. Vibration Mountings & Controls, Inc.

10. Amber/Booth

Vibro-Coustics Co.

B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

2. Minimum Additional Travel: 50 percent of the required deflection at rated load.

3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).

6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

1.7 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.

2. California Dynamics Corporation.

3. Cooper B-Line, Inc.; a division of Cooper Industries.

4. Hilti Inc.

5. Loos & Co.; Seismic Earthquake Division.

6. Mason Industries.

7. TOLCO Incorporated; a brand of NIBCO INC.

8. Unistrut; Tyco International, Ltd.

9. Amber/Booth

10. Vibro-Coustics Co.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

1.8 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.

2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.

3. Baked enamel or powder coat for metal components on isolators for interior use.

4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

2.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

2.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.

2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure as indicated on drawings, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

2.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

2.5 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Nameplates and labels for:

a. Electrical Distribution Switchboards, Panelboards, Junction Boxes, and as indicated on the drawings.

b. Provide a typed copy of the electrical panel schedule in each panel.

2. Wire and cable markers.

3. Conduit markers.

1.3 QUALITY ASSURANCE

A. Comply with:

1. ANSI A 13.1., Identification of Piping Systems.

2. National Electrical Code. (NEC)

3. Local Rules & Regulations.

1.4 REFERENCES. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work. In conflict between referenced standards and contract documents, notify Architect/Engineer immediately. Confirm notification in writing. Do not proceed with the work until the Architect/Engineer issues written instructions.

A. American National Standards Institute (ANSI): ANSI A13.1 - Identification of Piping Systems.

B. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC).

C. Manufacturers' Catalogs: Specification manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.5 SUBMITTALS

A. Submit product data.

B. Submit list of wording, symbols, letter size, and color coding for each piece of equipment specified.

C. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

A. Nameplates: Engraved two - layer laminated plastic, white letters on black background.

B. Size of plate shall be commensurate with lettering thereon.

C. Lettering for major items of equipment, such as a switchboard, shall be 1/2" in height. Lettering for smaller items, such as switches, shall be 1/4" in height.

D. Working on plate shall contain the following information as appropriate.

1. Drawing nomenclature, such as LP-1.

2. Equipment served, such as AHU-1.

3. Voltage.

2.2 CONDUIT SYSTEM IDENTIFICATION

A. Identify all conduits run exposed or above suspended ceilings.

B. Identification of conduits shall be by either identification markers or color coding.

1. Identification Markers:

a. Shall be standard pipe markers with black lettering on safety orange background.

b. Markers shall identify voltage and functional use of the conduit, such as "120/208 Volt Normal Power" or "Low voltage Fire Alarm".

2. Color Coding:

a. Color code shall consist of a background color and one or three identification stripes.

b. Prior to applying the stripes, paint all conduit and boxes with background color.

c. Apply identification stripes within three feet of all floor, ceiling and wall penetrations and equipment terminations. Apply additional stripes at intervals not exceeding 25 feet.

d. Stripes shall be 2-1/2 inch wide, completely circling the conduit. Stripes may be painted or colored banding tape.

e. Color code:

	Service	Background	Stripes
1)	277/480 V, 3 Phase	Orange	Single Red Stripe
2)	120/208V, Three Phase	Orange	Red-Yellow-Red
3)	120 volt controls	Orange	Green-White-Green
4)	Fire Alarm	Red	Single Orange Stripe
5)	Emergency power & Exit Signs	Red	Single Green Stripe
6)	Telephone	White	Single Orange Stripe

7)	Intercom	White	Single Black Stripe
8)	Program Systems	White	Single Green Stripe
9)	Television	White	Single Red Stripe
10)	Low Voltage Controls	White	Yellow-Green-Yellow
11)	Data/Computer	White	Black-Yellow-Black

f. Provide a legend of color codes in each mechanical room.

2.3 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams and equipment manufacturer's shop drawings for control wiring.

B. Wire Insulation Color:

120/208V 3 Phase	277/480V 3 Phase
Phase A Black	Phase A Brown
Phase B Red	Phase B Orange
Phase C Blue	Phase C Yellow
Neutral White	Neutral Gray
Equipment Ground Green	Equipment Ground Green
Isolated Ground w/ Yellow Tracer	Isolated Ground Green w/ Yellow Tracer

C. Code all wire and cable larger than color coded sizes available from manufacturer by application of electrical plastic tape in colors specified. Apply tape in uniform manner circling wire or cable. Half-lap tape for length of cable as required by Local Authorities or NEC. Tape shall be 3M, Plymouth or Permacel.

D. Maintain consistent coding throughout installation to ensure proper phase and system identification.

E. Control wiring may use numbered or lettered marker tape. Record wiring so marked on project documents. Marker tape shall be 3M Scotch Code, Panduit Insta-Code, T&B E-Z, Stranco Tuff-Code, Bradypack or Electrovert.

F. Mark individual conductors at each termination of tray cable. Identify circuit phase, neutral, equipment ground and isolated ground.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws, rivets, or adhesive.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Paint colored band on each conduit longer than 6 feet.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Indoor occupancy sensors.

2. Emergency shunt relays.

B. Related Sections include the following: List below only products that the reader might expect to find in this Section but are specified elsewhere.

1. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

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

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 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.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Watt Stopper
2. Acuity Brands Lighting, Inc.
3. Leviton Mfg. Company Inc.
4. Hubbell, Inc.
5. Novitas, Inc.
6. RAB Lighting, Inc.
7. Sensor Switch, Inc.

B. General Description: Wall or ceiling-mounting, solid-state units with a separate relay unit.

1. Ceiling Mounted Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Wall Mounted Vacancy Only Operation: Unless otherwise indicated, manual on and automatic off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes. Provide single or dual relay as indicated on the drawings. Provide dimming capability where indicated on the drawings.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
4. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.

5. Mounting:

   a. Sensor: Suitable for mounting in any position on a standard outlet box.

   b. Relay: Integral to unit compatible with single gang box mounting.

   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

6. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

7. Bypass Switch: Override the on function in case of sensor failure.

8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.

2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.2 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work and shall be replaced to comply with the manufacturers specifications.

END OF SECTION 260923

SECTION 262726 - WIRING DEVICES

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. Straight-blade convenience, commercial/industrial grade, and tamper-resistant receptacles.
2. GFCI receptacles.
3. Toggle switches.
4. Wall switch sensor light switches with dual technology sensors.
5. Wall plates.
6. Prefabricated multioutlet assemblies.

1.3 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

H. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for marking wall plates.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

D. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

E. Provide devices with right angle pigtailed snap connect terminals.

2.2 STRAIGHT-BLADE RECEPTACLES

A. Commercial/Industrial Grade, Heavy Duty, Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Leviton Manufacturing Co., Inc.
c. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. Provide device with right angle pigtailed snap connect terminal.

B. Tamper-Resistant Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Eaton (Arrow Hart).
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

2. Provide device with right angle pigtailed snap connect terminal.

2.3 GFCI RECEPTACLES

A. General Description:

1. 125 V, 20 A, straight blade, feed through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
4. Provide device with right angle pigtailed snap connect terminal.

B. Duplex GFCI Convenience Receptacles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Eaton (Arrow Hart).
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

C. Tamper-Resistant, Duplex GFCI Convenience Receptacles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Eaton (Arrow Hart).
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

2.4 USB RECEPTACLES

A. USB Charging Receptacles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.5 A per receptacle (minimum).
4. Standards: Comply with UL 1310 and USB 3.0 devices.
5. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Eaton (Arrow Hart).
2) Hubbell Incorporated; Wiring Device-Kellems.
3) Leviton Manufacturing Co., Inc.
4) Pass & Seymour/Legrand (Pass & Seymour).

2. Two Pole:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Eaton (Arrow Hart).
2) Hubbell Incorporated; Wiring Device-Kellems.
3) Leviton Manufacturing Co., Inc.
4) Pass & Seymour/Legrand (Pass & Seymour).

3. Three Way:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Eaton (Arrow Hart).
2) Hubbell Incorporated; Wiring Device-Kellems.
3) Leviton Manufacturing Co., Inc.
4) Pass & Seymour/Legrand (Pass & Seymour).

2.6 WALL SWITCH SENSOR LIGHT SWITCH, DUAL TECHNOLOGY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Leviton Manufacturing Co., Inc.
3. Watt Stopper.
4. Sensor Switch, Acuity Brands.

B. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual technology.

1. Connections: Provisions for connection to BAS.
2. Connections: Hard wired.
3. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.
4. Adjustable time delay of up to 30 minutes.
5. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.
6. Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.7 OCCUPANCY SENSORS

A. Wall-Switch Sensors (Single Relay):

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

a. Hubbell; AD1277*1 (* denotes device color).
b. Leviton; OSSMT-MA.
c. Watt Stopper; DSW-100.

2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1000 sq. ft.

B. Wall-Switch Sensors (Dual Relay):

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; AD1277*2 (* denotes device color).
b. Leviton; OSSMD-MA.
c. Watt Stopper; DW-200.

3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1000 sq. ft.

C. Ceiling Occupancy Sensors:

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

a. Leviton; OSC20-MAW.
b. Hubbell; LVDT2000R.
c. Watt Stopper; DT-355.

Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 360-degree field of view, with minimum coverage of 1000 sq. ft. Minimum switch rating: 1200-VA fluorescent.

2.8 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof “While-in-Use” Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.9 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

B. Wall Plate Color: Match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening. Coordinate both paragraphs below with Drawings.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with blac**k** filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. Prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports and submit to engineer.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES

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. Base Bid:

1. Contractor Provide:

a. Fusible switches.

b. Nonfusible switches.

c. Fuses.

1.3 REFERENCES

A. NEMA KS 1 - Enclosed Switches.

B. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Product Data: Provide switch ratings and enclosure dimensions.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified Independent Testing Laboratory for purpose

specified and shown.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D.

B. Eaton.

C. General Electric

D. Siemens

2.2 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

C. Enclosures: NEMA KS 1.

1. Interior Dry Locations: Type 1.

2. Exterior Locations: Type 3R.

2.3 FUSES

A. Manufacturers:

1. Bussman.

2. Gould.

3. Little Fuse.

B. Description: Dual element, current limiting, time delay, one-time fuse, 600 volt (480V Operation) or 250V (208V Operation, NRTL Class RK 1.

C. Interrupting Rating: 200,000 rms amperes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches where indicated.

B. Install fuses in fusible disconnect switches.

C. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

END OF SECTION 262816

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. IP: International Protection or Ingress Protection Rating

D. LED: Light emitting diode.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including driver housing if provided.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units.
3. “L” and “B” values identified for LEDs.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, drivers, and accessories identical to those indicated for the lighting fixture as applied in this Project.
7. LED and driver product data.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

D. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

E. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

F. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. LED light fixture warranty shall be a minimum of 5 years from the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on the Light Fixture Schedule.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. LED sources: Ensure color consistency among luminaires as specified in lighting fixture schedule. CRI minimum of 85.

D. Provide LEDs and drivers that are field replaceable without soldering.

E. Correlated Color Temperature shall be 3500K with efficacy minimum of 90 lumens/watt.

F. TM21 projection shall be at least 50,000 hours at L70.

G. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

H. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit access to lamps and drivers without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during servicing and when secured in operating position.

I. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: See Light Fixture Schedule.
b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

J. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and drivers. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

2.3 LED LAMPS

A. See Light Fixture Schedule on the drawings.

2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

C. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install support wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install two independent support wires from structure to tabs on lighting fixture. Wire shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Cable-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use cable for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner.

END OF SECTION 265100

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Excavating and backfilling trenches for utilities and pits for buried utility structures inside the building.

1.2 DEFINITIONS

A. Backfill: Soil 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. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. 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, will be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other fabricated stationary features constructed above or below the ground surface.

I. 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.

J. 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.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 INFORMATIONAL SUBMITTALS

A. Material test reports.

1.4 FIELD CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

C. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

D. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

E. Drainage Course: Narrowly graded mixture of crushed stone or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

F. Flowable Fill: Controlled low strength material (CLSM) that is self-leveling and self-compacting, cementitious material with an unconfined compressive strength of 100 psi per ASTM D 2832.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

B. 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 to comply with local practice or requirements of authorities having jurisdiction.

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 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.

3.3 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

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: 12 inches each side of pipe or conduit.

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. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.4 SUBGRADE INSPECTION

A. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.5 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.

3.6 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade.
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, 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.

3.7 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 033000 "Cast-in-Place Concrete."

D. Initial Backfill: 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.

E. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 VOID BACKFILL

A. Fill voids under pool deck and pool slab by pumping flowable fill into the void area. Fill void entirely with flowable fill per ASTM D 4832 to the satisfaction of the Architect.

3.9 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 D698:

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. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.10 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage 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.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.11 FIELD QUALITY CONTROL

A. Special Inspections: Contractor will engage a qualified special inspector to perform inspections:

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. 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.

3.12 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.

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.

3.13 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.

END OF SECTION 312000

APPENDIX 1

ASBESTOS MANAGEMENT PLAN
2018 REINSPECTIONS SURVEY REPORT

Project Location:
MISSOURI SCHOOL FOR THE BLIND BUILDING #14 – EAST WING
3815 Magnolia
St. Louis, MO 63110

Prepared for:
STATE OF MISSOURI
301 W. High Street
Jefferson City, MO 65102

Designated Person:
Christopher McDonnell
(573) 751-3266

Project Number: 918071
Date: January 28, 2019

Prepared by:

OCCU-TEC
ENERGY, ENVIRONMENTAL AND SAFETY SOLUTIONS
100 NW Business Park Lane • Riverside, MO 64150
816-231-5580 • www.occutec.com

Inspected by:
Clayton Goth
Missouri Asbestos Inspector (7011011018MOII19584)
Date of Inspection: November 13, 2018

Section:

Drawing Indicating Positive Asbestos Material Locations and Updated Photos

1 Introduction

2 Description of Building Construction and Systems

3 Summary of Findings for Suspect Materials

4 Material Information Tables

5 Removal Cost Estimate Summary

Appendices

A Definitions of Terms and Assessment Criteria

B Bulk Sampling Protocol and Analytical Methods

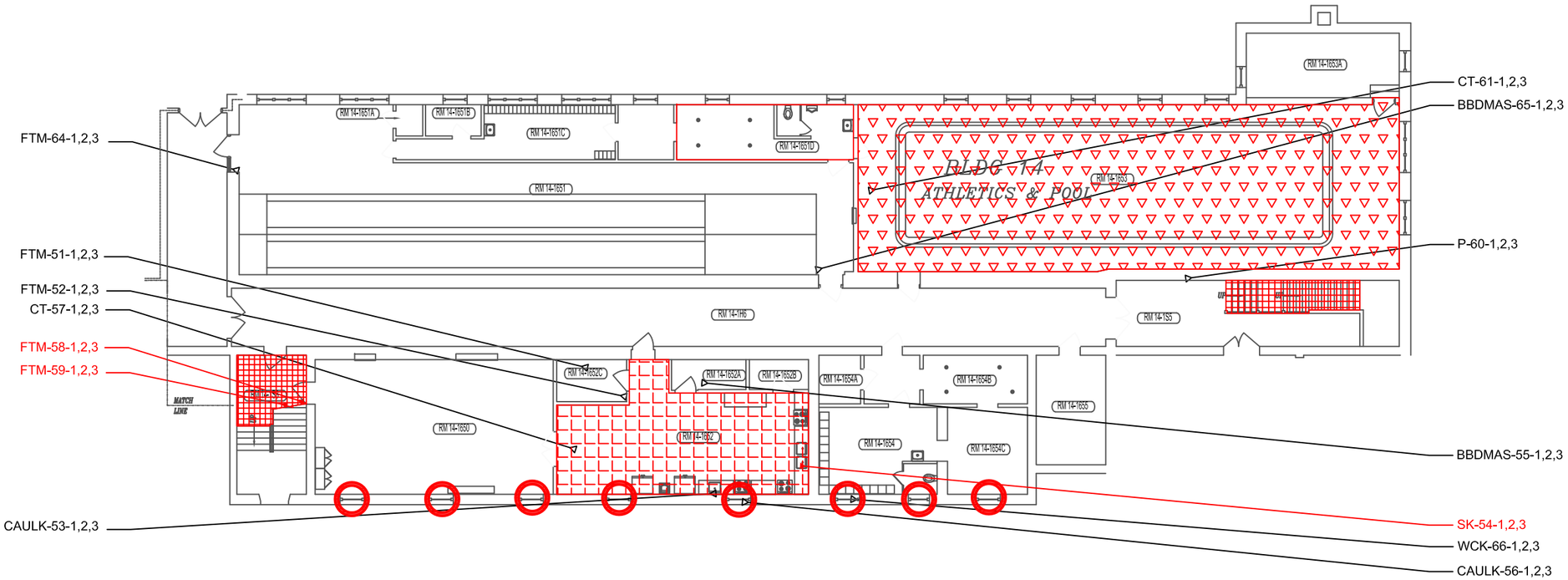
C Laboratory Bulk Sampling Reports

D TEM Laboratory Baseline Air Sampling Reports

E Summary of Regulatory Requirements

F Building Inspector Certifications

G O & M Plan (same plan is used for all schools)



IDENTIFIED ACM LEGEND

- PIPE AND FITTING INSULATION
- DRYWALL CEILING JOINT COMPOUND
- FLOOR TILE AND ASSOCIATED MASTIC
- SINK UNDERCOATING
- TAR PAPER (UNDER FLOOR TILE)
- ASSUMED LIGHT REFLECTOR PAPER
- EXTERIOR WINDOW CAULK

ASBESTOS BULK SAMPLE LEGEND

▲ = SAMPLE CONTAINS ASBESTOS

△ = SAMPLE WAS NEGATIVE FOR ASBESTOS

ASBESTOS INSPECTION NOTES

1. ADDITIONAL ASBESTOS MATERIALS MAY BE PRESENT IN UNACCESSIBLE LOCATIONS.

Plan North

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ENERGY, ENVIRONMENTAL AND SAFETY SOLUTIONS
4151 N. Mulberry Drive, Suite 275 • Kansas City, MO 64116
816.231.5580 • www.occutec.com

TITLE: ASBESTOS PLAN

CLIENT NAME: STATE OF MISSOURI - DESE

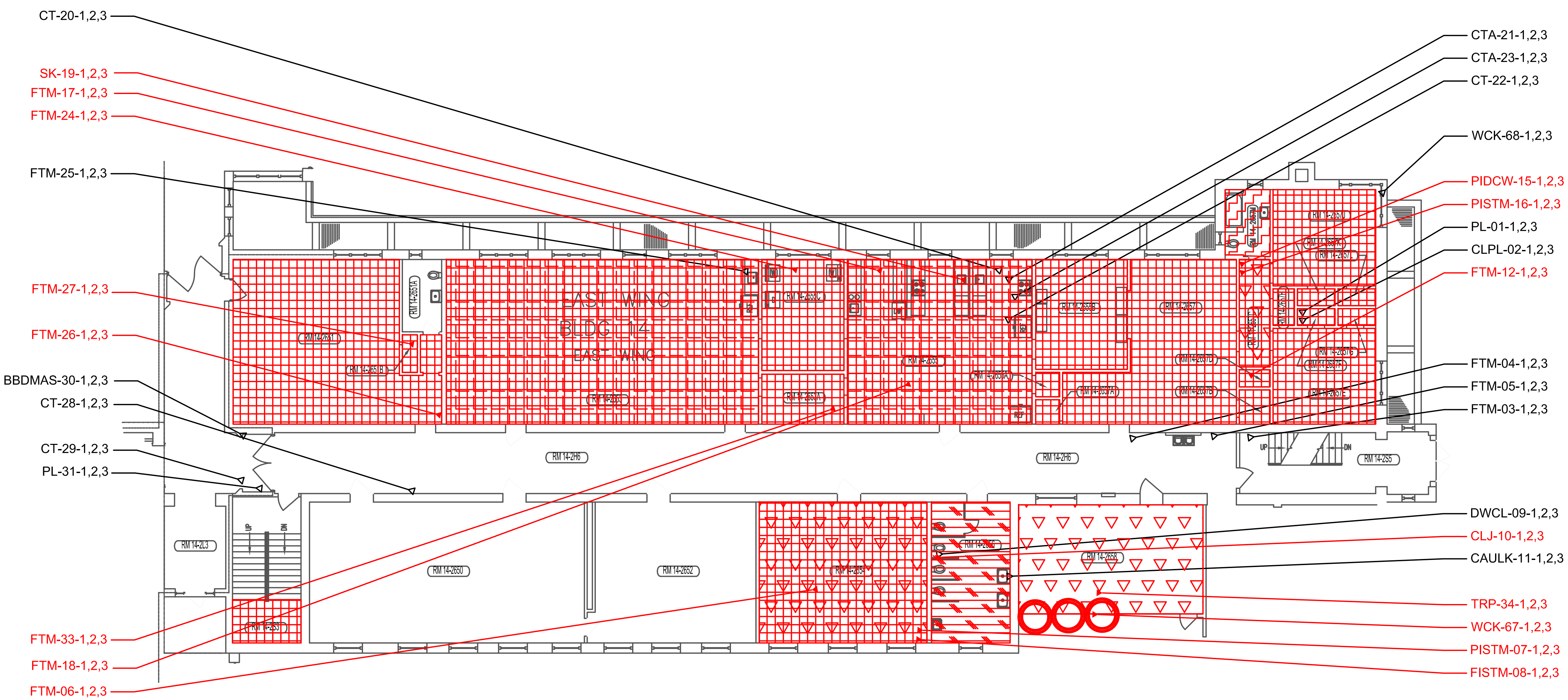
SCHOOL NAME: SCHOOL FOR THE BLIND - BLG. 14 - BASEMENT

DRAWN by: STB

SUB. DATE: 09/02/14

SCALE: 1/64" = 1'-0"

93055 | 1 of 3



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SCHOOL NAME: SCHOOL FOR THE BLIND - BLG. 14 - 1st FLOOR	SCALE: 1/64" = 1'-0"
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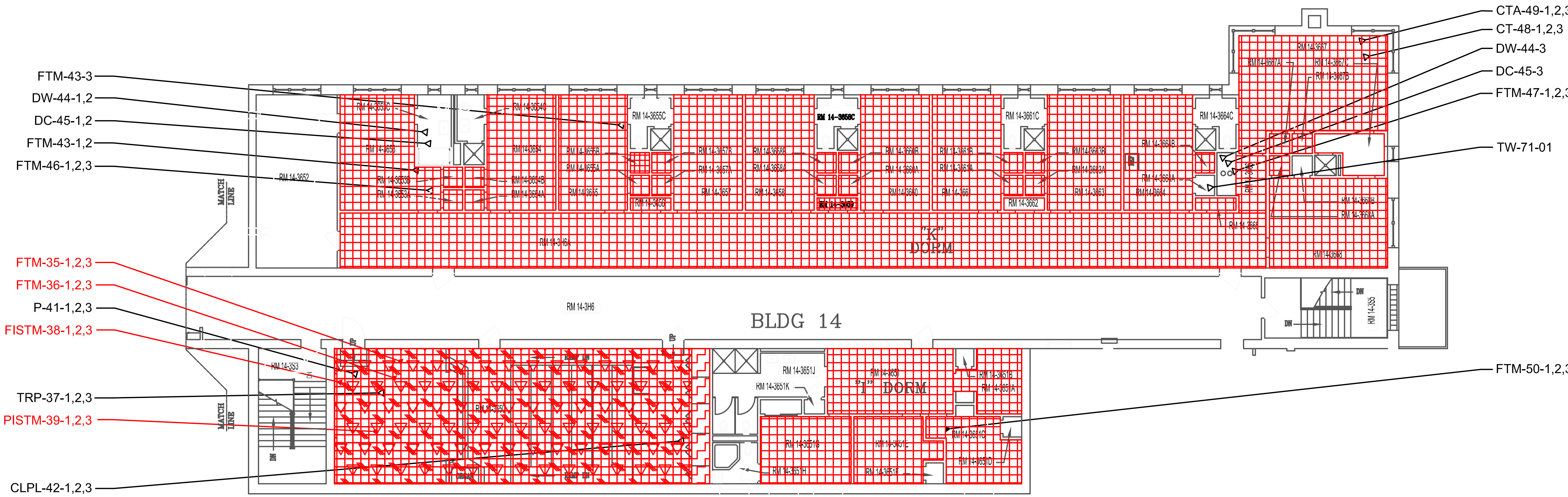

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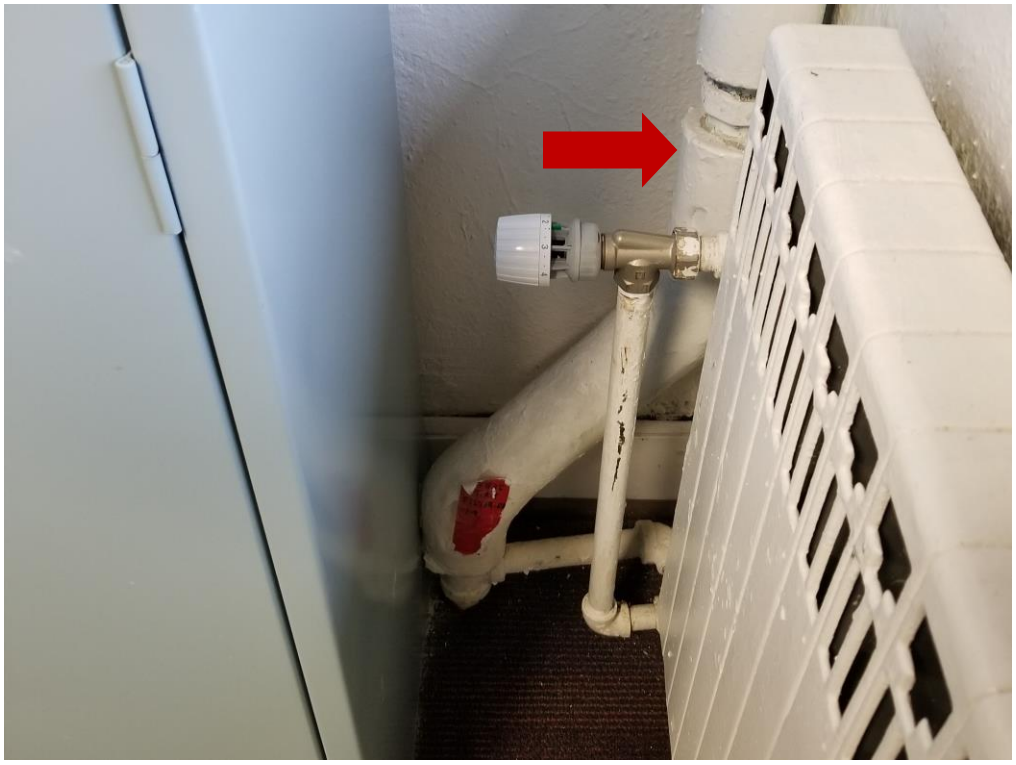
	93055	3 of 3

HM #6 – Asbestos-Containing Floor Tile & Mastic – 12”x12” tan with brown & cream streaks

HM #7 – Asbestos-Containing Pipe Insulation – grey, aircell steam lines

HM #8 – Asbestos-Containing Pipe Fittings – grey steam lines



HM #12 – Asbestos-Containing Floor Tile & Mastic – 9”x9” tan with brown and cream streaks

HM #13 – Assumed Asbestos-Containing Light Reflector Paper - silver

HM #25 - Asbestos-Containing Floor Tile & Mastic – 9”x9” beige with thin brown and cream streaks

HM #26 - Asbestos-Containing Floor Tile & Mastic – 9”x9” teal with white and dark teal smears

HM #27 - Asbestos-Containing Floor Tile & Mastic – 9”x9” green dotty w/ white & dark green streaks

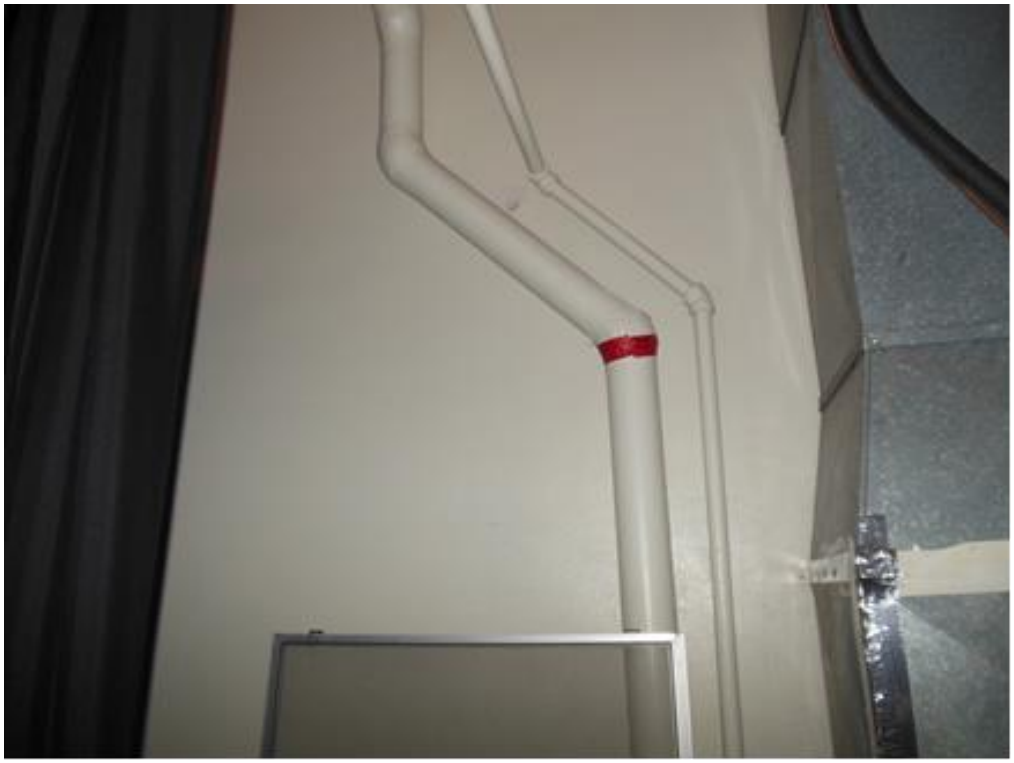
HM #33 - Asbestos-Containing Floor Tile & Mastic – 9”x9” dark brown with yellow streaks

HM #34 - Asbestos-Containing black tar paper underlayment

HM #35 - Asbestos-Containing Floor Tile & Mastic – 9”x9” cream with rust and grey streaks

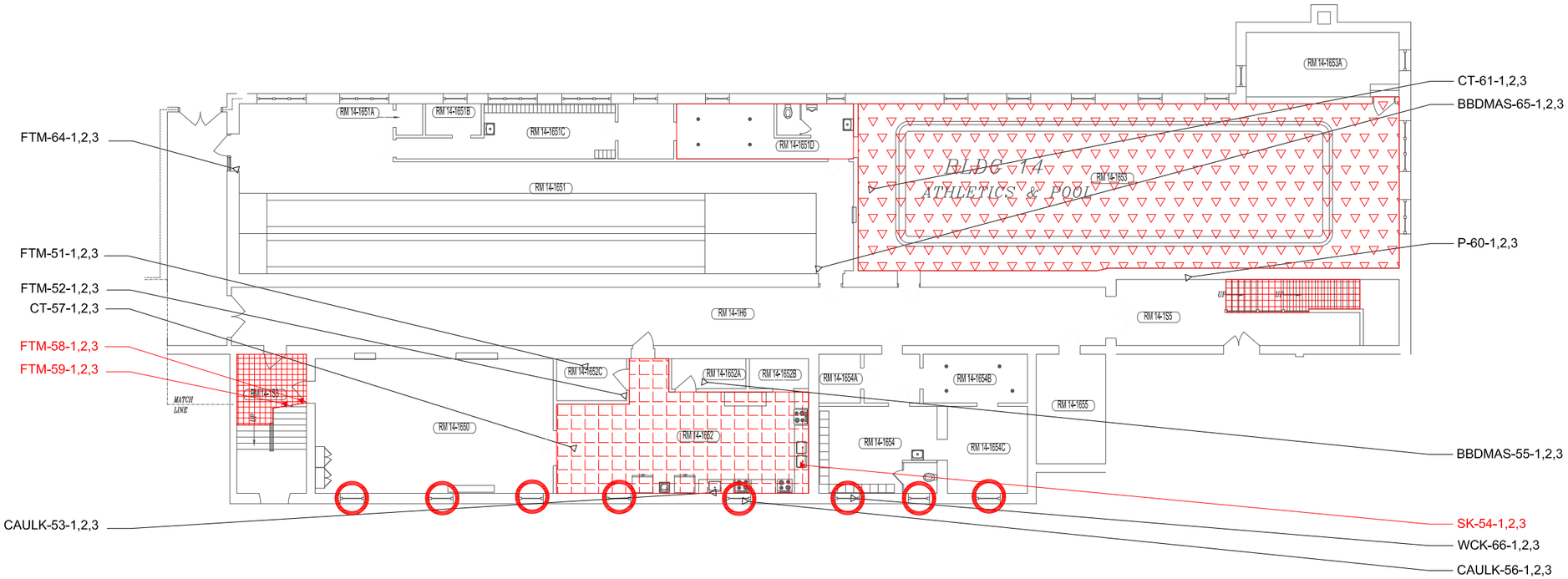
HM #36 – Asbestos-Containing Floor Tile & Mastic – 12”x12” cream

HM #38 – Asbestos-Containing Pipe Fittings – white, steam



HM #39 – Asbestos-Containing Pipe Insulation – white, steam

HM #50 – Asbestos-Containing Floor Tile & Mastic – white



Plan North

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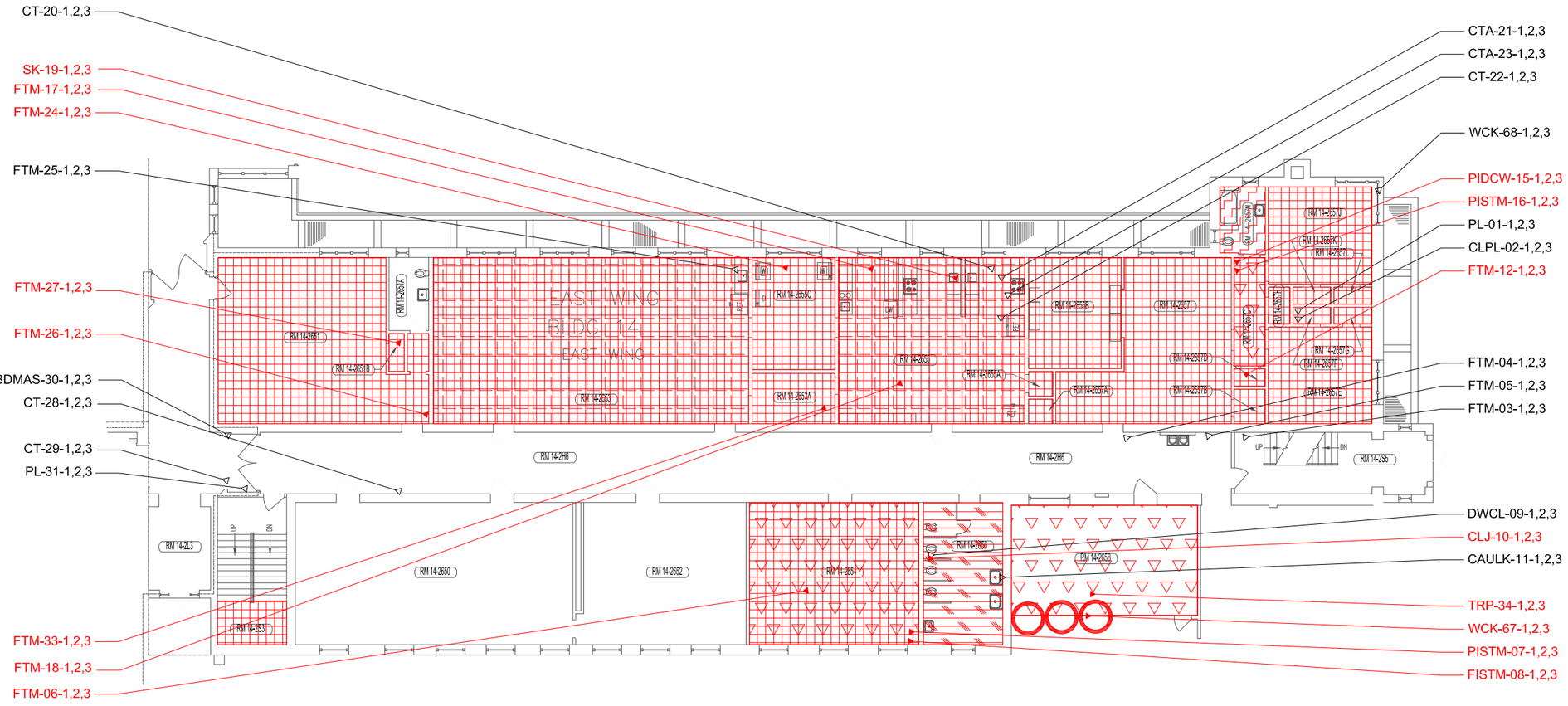
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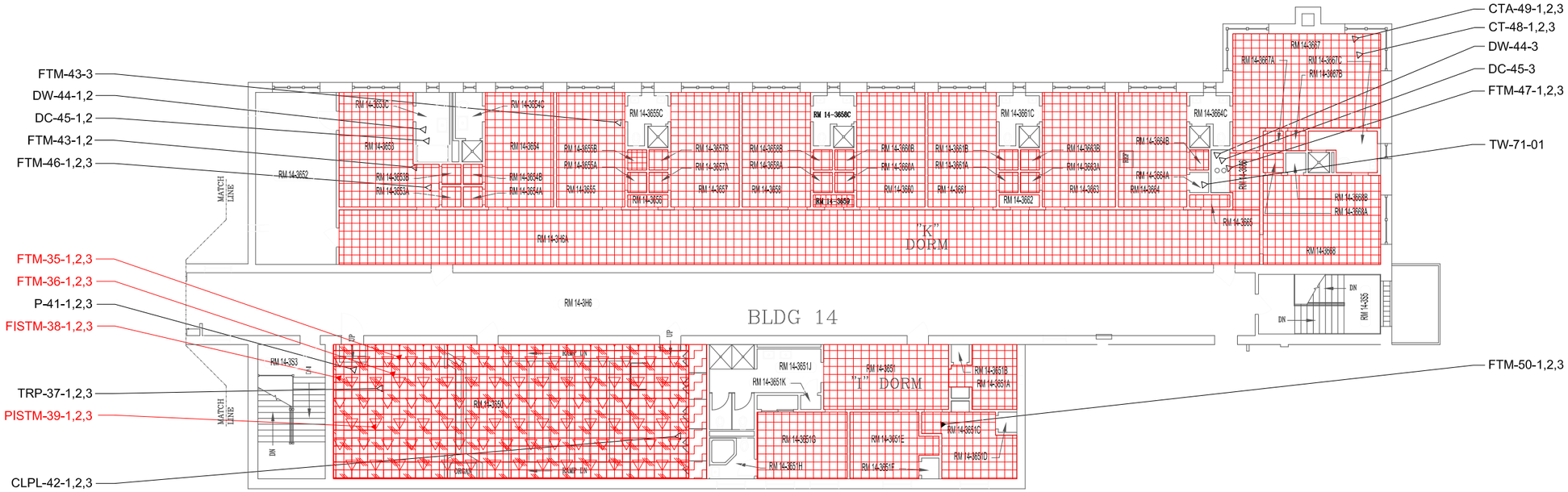
RM 14-2655BFR
RM 14-2655BFS
RM 14-2655BFT
RM 14-2655BFU
RM 14-2655BFV
RM 14-2655BFW
RM 14-2655BFX
RM 14-2655BFY
RM 14-2655BFZ
RM 14-2655BGA
RM 14-2655BGB
RM 14-2655BGC
RM 14-2655BGD
RM 14-2655BGE
RM 14-2655BGF
RM 14-2655BGG
RM 14-2655BGH
RM 14-2655BGJ
RM 14-2655BGK
RM 14-2655BGL
RM 14-2655BGM
RM 14-2655BGN
RM 14-2655BGP
RM 14-2655BGQ
RM 14-2655BGR
RM 14-2655BGS
RM 14-2655BGT
RM 14-2655BGU
RM 14-2655BGV
RM 14-2655BGW
RM 14-2655BGX
RM 14-2655BGY
RM 14-2655BGZ
RM 14-2655BHA
RM 14-2655BHB
RM 14-2655BHC
RM 14-2655BHD
RM 14-2655BHE
RM 14-2655BHF
RM 14-2655BHG
RM 14-2655BHH
RM 14-2655BHJ
RM 14-2655BHK
RM 14-2655BHL
RM 14-2655BHM
RM 14-2655BHN
RM 14-2655BHP
RM 14-2655BHQ
RM 14-2655BHR
RM 14-2655BHS
RM 14-2655BHT
RM 14-2655BHU
RM 14-2655BHV
RM 14-2655BHW
RM 14-2655BHX
RM 14-2655BHY
RM 14-2655BHZ
RM 14-2655BJA
RM 14-2655BJB
RM 14-2655BJC
RM 14-2655BJD
RM 14-2655BJE
RM 14-2655BJF
RM 14-2655BJG
RM 14-2655BJH
RM 14-2655BJJ
RM 14-2655BJK
RM 14-2655BJL
RM 14-2655BJM
RM 14-2655BJN
RM 14-2655BJP
RM 14-2655BJQ
RM 14-2655BJR
RM 14-2655BJS
RM 14-2655BJT
RM 14-2655BJU
RM 14-2655BJV
RM 14-2655BJW
RM 14-2655BJX
RM 14-2655BJY
RM 14-2655BJZ
RM 14-2655BKA
RM 14-2655BKB
RM 14-2655BKC
RM 14-2655BKD
RM 14-2655BKE
RM 14-2655BKF
RM 14-2655BKG
RM 14-2655BKH
RM 14-2655BKJ
RM 14-2655BKK
RM 14-2655BKL
RM 14-2655BKM
RM 14-2655BKN
RM 14-2655BKP
RM 14-2655BKQ
RM 14-2655BKR
RM 14-2655BKS
RM 14-2655BKT
RM 14-2655BKU
RM 14-2655BKV
RM 14-2655BKW
RM 14-2655BKX
RM 14-2655BKY
RM 14-2655BKZ
RM 14-2655BLA
RM 14-2655BLB
RM 14-2655BLC
RM 14-2655BLD
RM 14-2655BLE
RM 14-2655BLF
RM 14-2655BLG
RM 14-2655BLH
RM 14-2655BLJ
RM 14-2655BLK
RM 14-2655BLL
RM 14-2655BLM
RM 14-2655BLN
RM 14-2655BLP
RM 14-2655BLQ
RM 14-2655BLR
RM 14-2655BLS
RM 14-2655BLT
RM 14-2655BLU
RM 14-2655BLV
RM 14-2655BLW
RM 14-2655BLX



IDENTIFIED ACM LEGEND

- PIPE AND FITTING INSULATION
- DRYWALL CEILING JOINT COMPOUND
- FLOOR TILE AND ASSOCIATED MASTIC
- SINK UNDERCOATING
- TAR PAPER (UNDER FLOOR TILE)
- ASSUMED LIGHT REFLECTOR PAPER
- EXTERIOR WINDOW CAULK

ASBESTOS BULK SAMPLE LEGEND

▲ = SAMPLE CONTAINS ASBESTOS

△ = SAMPLE WAS NEGATIVE FOR ASBESTOS

ASBESTOS INSPECTION NOTES

1. ADDITIONAL ASBESTOS MATERIALS MAY BE PRESENT IN UNACCESSIBLE LOCATIONS.

Plan North

OCCU-TEC
ENERGY, ENVIRONMENTAL AND SAFETY SOLUTIONS
4151 N. Mulberry Drive, Suite 275 • Kansas City, MO 64116
816.231.5580 • www.occutec.com

TITLE: ASBESTOS PLAN

CLIENT NAME: STATE OF MISSOURI - DESE

SCHOOL NAME: SCHOOL FOR THE BLIND - BLG. 14 - 2nd FLOOR

DRAWN by: STB

SUB. DATE: 09/02/14

SCALE: 1/64" = 1'-0"

93055 | 3 of 3

Section 1 Introduction

OCCU-TEC, Inc. (OCCU-TEC) performed an Asbestos Hazard Emergency Response Act (AHERA) three-year reinspection of the facility to reassess known asbestos-containing building materials (ACBMs) that have been previously identified in the building. This reinspection report identifies all suspect ACBMs. Positive asbestos containing material samples are highlighted in red on the attached floor plan while negative materials are highlighted in black. Additionally, ACBMs are characterized as either friable or non-friable and were reassessed for present condition and hazard potential.

Friable ACBMs are materials that can be reduced to powder by hand pressure such as fireproofing, sprayed-on acoustic ceilings, ceiling tile, pipe insulation, and other miscellaneous materials. Because friable materials are more likely to release asbestos fibers into the air when disturbed than non-friable materials, friable materials are considered a greater health concern. Other materials such as floor tile, mastics, stucco and roofing are considered non-friable materials. Non-friable materials can become friable by crushing, sanding, sawing, shot-blasting, severe weathering or by other mechanically induced means.

Removal cost estimates are for budgeting purposes only and should not be used as a quote for removal of the materials. It is not our recommendation to remove these materials unless they are significantly damaged beyond repair, or if planned demolition or renovation activities could disturb the materials. These estimates are based on recent pricing from asbestos abatement firms performing similar work but may vary from actual competitive bidding.

REINSPECTION SUMMARY

During the 2018 reinspection, the licensed asbestos inspector was able to determine the removal of the following ACM in the specified locations that were previously noted in the 2004/2007/2013 asbestos reinspections.

HM Number	Location	Quantity
FTM-17	Room 14-2655	576 square feet
FTM-18	Room 14-2655	36 square feet
SK-19	Room 14-2655	12 units
FTM-24	Room 14-2655C	180 square feet

During the 2018 reinspection, the licensed asbestos inspector was not able to locate the following ACM in the specified locations that were previously noted in the 2004/2007/2013 asbestos reinspections. No other additional materials were identified or sampled. Please refer to the 2004/2007/2013 AHERA Management Plan for additional information.

HM Number	Location
FTM-58	Room 14-1S3
FTM-59	Room 14-1S3
PIAIR-62	Room 14-1653
PE-63	Room 14-1653

OCCU-TEC also considered roofing materials to be outside of the AHERA inspection scope of work. Any future projects impacting the roofing materials would require sampling of those materials prior to renovation.

DISCLAIMER

This report is prepared for the express use and benefit of State of Missouri, its agents and employees. The information in this report or portions thereof may be required to be included in notifications to employees, contractors or other visitors to the building(s). This report is not intended to be used as a specification or work plan for any of the work suggested or recommended in this report.

This report is based upon conditions and practices observed at the property and information made available to the surveyor. Because OCCU-TEC Inc. did not perform destructive sampling on structural elements, the possibility exists that some Asbestos Containing Materials (ACM) were not identified in this inspection which could be located in inaccessible areas (within walls, pipe chases, ducts, etc.). 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 references only materials determined to be ACM. For a complete list of all homogeneous materials sampled at the subject property as part of ongoing asbestos management operations, the reader should refer to the Asbestos Management Plan and Reinspection Reports completed in 2004, 2007, and 2013.

Section 2 Description of Building Construction and Systems

Number of Floors: 2 **Year Built:** 1959 **Total Square Footage:** 5,404

Building Description/Comments:

The subject property consists of brick and mortar construction with a concrete foundation.

Section 3 Summary of Positive Homogeneous Materials

Each unique material within the building has been assigned a unique Homogenous Material/HM number by the surveyor at the time of the inspection. A homogenous material as defined by EPA AHERA is an area of surfacing material, thermal system insulation material, or miscellaneous material that is uniform in color and texture. This section is organized sequentially by homogenous material number.

Complete information on asbestos containing materials is included in Section 4 of this report.

Site Information	*Survey Performed By*	*Inspection Date*
East Wing	**OCCU-TEC, INC.**	**November 13, 2018**

Suspect Material	HM Number	Material Location(s)	Floor	Asbestos Present
12 x12 Tan w/ Brown & Cream Streaks Floor Tile & Mastic under capet	FTM-06	Room 14-2654	1	Yes
Gray Aircell Piping - Steam	PISTM-07	Room 14-2654	1	Yes
Gray Mudded Fitting - Steam	FISTM-08	Room 14-2654	1	Yes
		Room 14-2658	1	Yes
9 x9 Tan w/ brown & Cream Streaks Floor Tile & Mastic	FTM-12	Room 14-1S5	B	Yes
		Room 14-2653	1	Yes
		Room 14-2655	1	Yes
		Room 14-2655A	1	Yes
		Room 14-2655B	1	Yes
		Room 14-2657	1	Yes
		Room 14-2657A	1	Yes
		Room 14-2657B	1	Yes
		Room 14-2657C	1	Yes
		Room 14-2657D	1	Yes
		Room 14-2657E	1	Yes
		Room 14-2657F	1	Yes
		Room 14-2657G	1	Yes
		Room 14-2657H	1	Yes
		Room 14-2657J	1	Yes
		Room 14-2657K	1	Yes
		Room 14-2657L	1	Yes
		Room 14-2S3	1	Yes
		Room 14-3653	2	Yes
		Room 14-3653A	2	Yes
		Room 14-3653B	2	Yes
		Room 14-3655	2	Yes
		Room 14-3655A	2	Yes
		Room 14-3655B	2	Yes

Suspect Material	HM Number	Material Location(s)	Floor	Asbestos Present
		Room 14-3658	2	Yes
		Room 14-3658A	2	Yes
		Room 14-3658B	2	Yes
		Room 14-3661	2	Yes
		Room 14-3661A	2	Yes
		Room 14-3661B	2	Yes
		Room 14-3664	2	Yes
		Room 14-3664B	2	Yes
		Room 14-3666	2	Yes
		Room 14-3667	2	Yes
		Room 14-3667A	2	Yes
		Room 14-3667B	2	Yes
		Room 14-3668	2	Yes
		Room 14-3668A	2	Yes
		Room 14-3H6A	2	Yes
Silver Light Reflector Paper	LRP-13	Room 14-2657M	1	Yes (assumed)
		Room 14-3650	2	Yes (assumed)
Gray Aircell Piping - Chilled Water System	PICHW-15	Room 14-2657C	1	Yes
Gray Aircell Piping - Steam	PISTM-16	Room 14-2657C	1	Yes
Black Sink Undercoating	SK-19	Room 14-2653	1	Yes
		Room 14-1652	B	Yes
9 x9 Beige Thin Brown & Cream Streaks Floor Tile & Mastic	FTM-25	Room 14-2653	1	Yes
		Room 14-3653	2	Yes
9 x9 Teal w/ White & Dark Teal Smears Floor Tile & Mastic	FTM-26	Room 14-2651	1	Yes
		Room 14-2S3	1	Yes
		Room 14-3654	2	Yes
		Room 14-3654A	2	Yes
		Room 14-3654B	2	Yes
		Room 14-3657	2	Yes
		Room 14-3657A	2	Yes
		Room 14-3657B	2	Yes
		Room 14-3660	2	Yes
		Room 14-3660A	2	Yes
		Room 14-3660B	2	Yes
		Room 14-3663	2	Yes
		Room 14-3663A	2	Yes
		Room 14-3663B	2	Yes

Suspect Material	HM Number	Material Location(s)	Floor	Asbestos Present
9 x9 Green Dotty w/ White & Dark Green Streaks Floor Tile & Mastic	FTM-27	Room 14-2651B	1	Yes
		Room 14-1652	B	Yes
9 x9 Dark Brown w/ Yellow & White Streaks Floor Tile & Mastic	FTM-33	Room 14-2653A	1	Yes
		Room 14-3656	2	Yes
		Room 14-3659	2	Yes
		Room 14-3662	2	Yes
		Room 14-3665	2	Yes
9 x9 Cream w/ Rust & Gray Streaks Floor Tile & Mastic	FTM-35	Room 14-3650	2	Yes
		Room 14-3653	2	Yes
12 x12 Unknown Color Floor Tile & Mastic	FTM-36	Room 14-3650	2	Yes
White Fitting - Steam	FISTM-38	Room 14-3650	2	Yes
White Piping - Steam	PISTM-39	Room 14-3650	2	Yes
White Floor Tile & Mastic Under Carpet	FTM-50	Room 14-3651	2	Yes
		Room 14-3651A	2	Yes
		Room 14-3651C	2	Yes
		Room 14-3651E	2	Yes
		Room 14-3651G	2	Yes
9 x9 Beige w/ Multi-colored Streaks Floor Tile & Mastic	FTM-58	Room 14-1S3	B	Yes
9 x9 Burnt Rust w/ Red & White Streaks Floor Tile & Mastic	FTM-59	Room 14-1S3	B	Yes
Gray Piping - Aircell Insulation NO ACCESS	PIAIR-62	Room 14-1653	B	Yes (assumed)
Gray Pipe Elbows	PE-63	Room 14-1653	B	Yes (assumed)
White Exterior Window Caulking	WCK-67	Exterior, South	EXT	Yes
No Access	NO ACC-71	Room 14-3664A	2	Yes (assumed)

Section 4 Material Information Tables

Site Information	***Client Information***
Missouri School for the Blind - Building 7 (Site ID: MSB)	State of Missouri
Building: Building 14 East Wing	301 W. High Street
3815 Magnolia	Jefferson City, MO 65102
St. Louis, MO 63110	

Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

Material Description	*Material Number*	*Asbestos Present*
Gray Aircell Pipping - Chilled Water System	PICHW-15	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
TSI	Friable	Friable	14	Linear Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2657C	1	14 LF	Good	Above Hard Ceiling

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
PICHW-15-1 Room 14-2657C Northwest Pipe Chase	1	Yes	50%	1) Insulation	50% Chrysotile
PICHW-15-2 Room 14-2657C Northwest Pipe Chase	1	Yes	Trace	1) Insulation	<1% Chrysotile
PICHW-15-3 Room 14-2657C Northwest Pipe Chase	1	Yes	50%	1) Insulation	50% Chrysotile

Material Description	*Material Number*	*Asbestos Present*
Gray Aircell Pipe - Steam	PISTM-07	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
TSI	Friable	Friable	45	Linear Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2654	1	45	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
PISTM-07-01 Room 14-2654 Southeast	1	Yes	30%	1) Insulation	30% Amosite
SK-15-2 RM 14-2654 Southeast	1	No	NA	1) Insulation	NA
PISTM-07-3 RM 14-2654 Southeast	1	No	NA	1) Insulation	NA

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Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

Material Description	*Material Number*	*Asbestos Present*
Grey Aircell Piping - Steam	PISTM-16	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
TSI	Friable	Friable	14	Linear Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2657C	1	14 LF	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
PISTM-16-1 Room 14-2657C Northwest Pipechase	1	Yes	40%	1) Insulation	40% Chrysotile
PISTM-16-2 Room 14-2657C Northwest Pipechase	1	No	N/A	1) Insulation	Not Analyzed
PISTM-16-3 Room 14-2657C Northwest Pipechase	1	No	N/A	1) Insulation	Not Analyzed

Material Description	*Material Number*	*Asbestos Present*
Grey Mudded Fitting	FIST-08	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
TSI	Friable	Friable	24	Linear Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM-2654	1	20	Good	
RM 12-2658	1	4	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FSTM-08-1 Room 14-2654 Southeast	1	Yes	7%	1) Insulation	7% Chrysotile
FSTM-08-2 Room 14-2654 Southeast	1	No	N/A	1) Insulation	Not Analyzed
FSTM-08-13Room 14-2654 Southeast	1	No	N/A	1) Insulation	Not Analyzed

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Missouri School for the Blind - Building 7 (Site ID: MSB)	State of Missouri
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3815 Magnolia	Jefferson City, MO 65102
St. Louis, MO 63110	

Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

Material Description	*Material Number*	*Asbestos Present*
Grey Pipe Elbows	PE-63	Yes (Assumed)

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
TSI	Friable	Friable	6	Linear Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-1653	1	6	Not Found	

Material Description	*Material Number*	*Asbestos Present*
Grey Piping - Aircell Insulation No Access	PAIR-62	Yes (Assumed)

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
TSI	Friable	Friable	80	Linear Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-1653	B	80	Not Found	

Material Description	*Material Number*	*Asbestos Present*
White Fitting - Steam	FISTM-38	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
TSI	Friable	Friable	3	Linear Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-3650	2	3	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FISTM-38-1 RM 14-3650 West	2	Yes	15%	1) Insulation	15% Chrysotile
FISTM-38-1 RM 14-3650 West	2	No	N/A	1) Insulation	Not Analyzed
FISTM-38-1 RM 14-3650 West	2	No	N/A	1) Insulation	Not Analyzed

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3815 Magnolia	Jefferson City, MO 65102
St. Louis, MO 63110	

Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

Material Description	*Material Number*	*Asbestos Present*
White Piping - Steam	PISTM-39	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
TSI	Friable	Friable	20	Linear Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-3650	2	20	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
PISTM-39-1 Rm 14-3650 West	2	Yes	60%	1) Insulation	60% Amosite
PISTM-39-2 Rm 14-3650 West	2	No	N/A	1) Insulation	Not Analyzed
PISTM-39-3 Rm 14-3650 West	2	No	N/A	1) Insulation	Not Analyzed

Material Description	*Material Number*	*Asbestos Present*
12" X 12" Tan with brown and cream streak Floor Tile & Mastic	FTM-06	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	480	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2654	1	480	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-06-1 Rm 14-2654 South	1	Yes	6%	1) Mastic 2) Floor Tile	2% Chrysotile 6% Chrysotile
FTM-06-1 Rm 14-2654 South	1	No	NA	1) Mastic 2) Floor Tile	NA
FTM-06-1 Rm 14-2654 South	1	No	NA	1) Mastic 2) Floor Tile	NA

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3815 Magnolia	Jefferson City, MO 65102
St. Louis, MO 63110	

Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

Material Description	*Material Number*	*Asbestos Present*
12" X 12" Unknown color Floor Tile & Mastic	FTM-36	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	350	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-3650	2	350	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-36-1 Rm 14-3650 Northwest	2	Yes	10%	1) Mastic 2) Floor Tile	10% Chrysotile 2% Chrysotile
FTM-36-1 Rm 14-3650 Northwest	2	No	NA	1) Mastic 2) Floor Tile	NA
FTM-36-1 Rm 14-3650 Northwest	2	No	NA	1) Mastic 2) Floor Tile	NA

Material Description	*Material Number*	*Asbestos Present*
9" X 9" Beige Thin brown and cream streaks Floor Tile & Mastic	FTM-25	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	144	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2653	1	112	Good	
RM 14-3653	2	32	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-25-1 Rm 14-2653 East Side	1	Yes	6%	1) Mastic 2) Floor Tile	2.5% Chrysotile 6% Chrysotile
FTM-25-1 Rm 14-2653 East Side	1	No	NA	1) Mastic 2) Floor Tile	NA
FTM-25-1 Rm 14-2653 East Side	1	No	NA	1) Mastic 2) Floor Tile	NA

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3815 Magnolia	Jefferson City, MO 65102
St. Louis, MO 63110	

Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

Material Description	*Material Number*	*Asbestos Present*
9" X 9" Beige with multi-colored streaks Floor Tile & Mastic	FTM-58	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	60	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-1S3	B	60	Not Found	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-58-1 RM 14-1S3 Southeast	B	Yes	8%	1) Mastic 2) Floor Tile	2% Chrysotile 8% Chrysotile
FTM-58-1 RM 14-1S3 Southeast	B	No	NA	1) Mastic 2) Floor Tile	NA
FTM-58-1 RM 14-1S3 Southeast	B	No	NA	1) Mastic 2) Floor Tile	NA

Material Description	*Material Number*	*Asbestos Present*
9" X 9" Burnt rust red and white streaks Floor Tile & Mastic	FTM-59	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	10	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-1S3	B	10	Not Found	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-59-1 RM 14-1S3 Southeast	B	Yes	5%	1) Mastic 2) Floor Tile	5% Chrysotile 5% Chrysotile
FTM-59-1 RM 14-1S3 Southeast	B	No	NA	1) Mastic 2) Floor Tile	NA
FTM-59-1 RM 14-1S3 Southeast	B	No	NA	1) Mastic 2) Floor Tile	NA

Site Information	***Client Information***
Missouri School for the Blind - Building 7 (Site ID: MSB)	State of Missouri
Building: Building 14 East Wing	301 W. High Street
3815 Magnolia	Jefferson City, MO 65102
St. Louis, MO 63110	

Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

Material Description	*Material Number*	*Asbestos Present*
9" X 9" Cream with rust and gray streaks Floor Tile & Mastic	FTM-35	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	1,384	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-3650	2	1,380	Good	
RM 14-3650	2	4	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-35-1 RM 14-3650 Northwest	2	Yes	3%	1) Mastic 2) Floor Tile	3% Chrysotile 2% Chrysotile
FTM-35-2 RM 14-3650 Northwest	2	No	NA	1) Mastic 2) Floor Tile	NA
FTM-35-3 RM 14-3650 Northwest	2	No	NA	1) Mastic 2) Floor Tile	NA

Material Description	*Material Number*	*Asbestos Present*
9" X 9" Dark brown with yellow and white streaks Floor Tile & Mastic	FTM-33	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	140	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2653A	1	84	Good	
RM 14-3656	2	14	Good	
RM 14-3659	2	14	Good	
RM 14-3662	2	14	Good	
RM 14-3665	2	14	Fair	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-33-1 RM 14-2653A Southwest	1	Yes	8%	1) Mastic 2) Floor Tile	8% Chrysotile 8% Chrysotile
FTM-33-2 RM 14-2653A Southwest	1	No	NA	1) Mastic 2) Floor Tile	NA
FTM-33-3 RM 14-2653A Southwest	1	No	NA	1) Mastic 2) Floor Tile	NA

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3815 Magnolia	Jefferson City, MO 65102
St. Louis, MO 63110	

Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

Material Description	*Material Number*	*Asbestos Present*
9" X 9" green dotty with white and dark green streaks Floor Tile & Mastic	FTM-27	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	201	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2651B	1	21	Good	
RM 14-1652	B	180	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-27-1 Rm 14-2651B	1	Yes	6%	1) Mastic 2) Floor Tile	2% Chrysotile 6% Chrysotile
FTM-27-2 Rm 14-2651B	1	No	NA	1) Mastic 2) Floor Tile	NA
FTM-27-3 Rm 14-2651B	1	No	NA	1) Mastic 2) Floor Tile	NA

Material Description	*Material Number*	*Asbestos Present*
9" X 9" Tan with brown and cream streaks Floor Tile & Mastic	FTM-12	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	4,884	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2657	1	445	Good	
RM 14-2657B	1	25	Good	
RM 14-2657C	1	64	Good	
RM 14-2657D	1	15	Good	
RM 14-2657E	1	255	Good	
RM 14-2657F	1	18	Good	
RM 14-2657G	1	18	Good	
RM 14-2657H	1	24	Good	
RM 14-2657J	1	255	Good	
RM 14-2657K	1	18	Good	
RM 14-2657L	1	18	Good	
RM 14-2657A	1	20	Good	
RM 14-2655A	1	16	Good	
RM 14-2653	1	936	Good	
RM 14-2655B	1	225	Good	
RM 14-2S3	1	35	Good	

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3815 Magnolia	Jefferson City, MO 65102
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Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

RM 14-3H6A	2	816	Good	Under Carpet
RM 14-3655	2	170	Good	
RM 14-3655A	2	9	Good	
RM 14-3655B	2	9	Good	
RM 14-3658	2	170	Good	
RM 14-3658A	2	9	Good	
RM 14-3658B	2	9	Good	
RM 14-3661	2	170	Good	
RM 14-3661A	2	9	Good	
RM 14-3661B	2	9	Good	
RM 14-3653	2	193	Good	
RM 14-3653A	2	9	Good	
RM 14-3653B	2	9	Good	
RM 14-3664	2	170	Good	
RM 14-3664B	2	9	Good	
RM 14-3666	2	44	Good	
RM 14-3667	2	308	Good	
RM 14-3667A	2	9	Good	
RM 14-3667B	2	9	Good	
RM 14-3668	2	221	Good	Under Carpet
RM 14-3668A	2	12	Good	
RM 14-1S5	B	88	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-12-1 Rm 14-2657D By Door	1	Yes	7%	1) Mastic 2) Floor Tile	3% Chrysotile 7% Chrysotile
FTM-12-2 Rm 14-2657D By Door	1	No	NA	1) Mastic 2) Floor Tile	NA
FTM-12-3 Rm 14-2657D By Door	1	No	NA	1) Mastic 2) Floor Tile	NA

Material Description	*Material Number*	*Asbestos Present*
9" X 9" Teal with white and dark teal streaks Floor Tile & Mastic	FTM-26	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	1,492	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2651	1	740	Good	
RM 14-2s3	1	10	Good	
RM 14-3654	2	160	Good	
RM 14-3654A	2	9	Good	

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Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

RM 14-3654B	2	9	Good		
RM 14-3657	2	170	Good		
RM 14-3657A	2	9	Good		
RM 14-3657B	2	9	Good		
RM 14-3660	2	170	Good		
RM 14-3660A	2	9	Good		
RM 14-3660B	2	9	Good		
RM 14-3663	2	170	Good		
RM 14-3663A	2	9	Good		
RM 14-3663B	2	9	Good		

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-26-1 RM 14-2651 Southeast	1	Yes	10%	Floor Tile	10% Chrysotile
FTM-26-2 RM 14-2651 Southeast	1	No	NA	Floor Tile	NA
FTM-26-3 RM 14-2651 Southeast	1	No	NA	Floor Tile	NA

Material Description	*Material Number*	*Asbestos Present*
White Floor Tile and Mastic	FTM-50	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Flooring	Non-Friable	Caregory-1	581	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-3651	2	180	Good	
RM 14-3651A	2	72	Good	
RM 14-3651C	2	99	Good	
RM 14-3651E	2	90	Good	
RM 14-3651G	2	140	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
FTM-50-1 RM 14-3651C	1	Yes	4%	1) Mastic 2) Floor Tile	4% Chrysotile 2% Chrysotile
FTM-50-2 RM 14-3651C	1	No	NA	1) Mastic 2) Floor Tile	NA
FTM-50-3 RM 14-3651C	1	No	NA	1) Mastic 2) Floor Tile	NA

Site Information	***Client Information***
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3815 Magnolia	Jefferson City, MO 65102
St. Louis, MO 63110	

Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

Material Description	*Material Number*	*Asbestos Present*
Black Sink Undercoating	SK-19	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Miscellaneous	Non-Friable	Caregory-1	16	Each

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2653	1	4	Good	
RM 14-1652	B	12	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
SK-54-1 RM 14-1652 East	1	Yes	15%	Sink Undercoat	15% Chrysotile
SK-54-1 RM 14-1652 East	1	No	NA	Sink Undercoat	NA
SK-54-1 RM 14-1652 East	1	No	NA	Sink Undercoat	NA

Material Description	*Material Number*	*Asbestos Present*
White Exterior Window Caulking	WCK-67	Yes

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Miscellaneous	Non-Friable	Caregory-1	584	Linear Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
Exterior, South	EXT	584	Good	

Sample IDs/Location	*Floor*	*Analyzed*	*Overall Result*	*Layer(s) reported by lab*	*Results by Layer*
WCK-67-1 Exterior South	1	Yes	15%	Sink Undercoat	15% Chrysotile
WCK-67-2 Exterior South	1	No	NA	Sink Undercoat	NA
WCK-67-3 Exterior South	1	No	NA	Sink Undercoat	NA

Material Description	*Material Number*	*Asbestos Present*
Silver Light Reflector	IRP-13	Yes (Assumed)

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
Miscellaneous	Non-Friable	Caregory-1	5	Square Feet

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
RM 14-2657M	1	1	Good	
RM 14-3650	2	2	Good	
RM 14-3667C	2	2	Good	

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3815 Magnolia	Jefferson City, MO 65102
St. Louis, MO 63110	

Survey Performed By	***Inspector***	***Inspection Date***	***Job Number***
OCCU-TEC, Inc.	Clayton Goth	November 13, 2018	918071

Material Description	*Material Number*	*Asbestos Present*
No Access	No ACC-71	Yes (Assumed)

Material Category	*Friable Classification*	*EPA Category*	*Total Quantity*	*Unit of Measurement*
		Needs Determination	1	

General Condition	*Overall Material Assessment*	*Recommended Response*
Good	Potential for Damage/No Damage	Operations & Maintenance

General Material Comments

Material Location(s)	*Floor*	*Location Quantity*	*Location Condition*	*Material Comments (by location)*
Room 14-3664A	2	1	Good	

Section 5 Removal Cost Estimate Summary

These estimates are for budgeting purposes only and should not be used as a quote for removal of the materials. It is not our recommendation to remove these materials unless they are beyond repair, or planned demolition or renovation activities will disturb the materials. Estimates are based on recent pricing we have received from contractors performing similar work and may vary from actual prices obtained due to the actual scope of work, quantity of material removed, control measures specified and contractor work loads, etc.

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

ROOM 14-2651

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9 x9 teal with white and dark teal smears Floor Tile & Mastic	26	740	Square Feet	$1480 - $3700
		Space Removal Costs			$1480 - $3700

Location

Room 14-2651B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9 x 9 Green Dotty with white & dark green streaks floor tile & mastic	27	21	Square Feet	$42 - $105
		Space Removal Costs			$42 - $105

Location

Room 14-2653

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category II	Black Sink Undercoadting	19	4	Each	$300 - $600
Category I	9x9 Beige thin brown and cream streaks floor tile & mastic	25	112	Square Feet	$224 - $560
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	936	Square Feet	$1872 - $4680
		Space Removal Costs			$2396 - $5840

Location

Room 14-2653A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Dark brown with yellow & white streaks Floor Tile & Mastic	33	84	Square Feet	$168 - $420
		Space Removal Costs			$168 - $420

Location

Room 14-2654

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	12x12 Tan w/ brown and cream streaks floor tile & mastic	6	480	Square Feet	$960 - $2400
Friable	Grey Aircell Piping - Steam	7	45	Linear Feet	$450 - $1125
Friable	Grey Mudded Fitting - Steam	8	20	Linear Feet	$200 - $500
		Space Removal Costs			$1610 - $4025

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

Room 14-2655A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	16	Square Feet	$32 - $80
		Space Removal Costs			$32 - $80

Location

Room 14-2655B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	225	Square Feet	$550 - $1,125
		Space Removal Costs			$550 - $1,125

Location

Room 14-2657

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	445	Square Feet	$890 -$ 2,225
		Space Removal Costs			$890 -$ 2,225

Location

Room 14-2657A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	20	Square Feet	$40 - $100
		Space Removal Costs			$40 - $100

Location

Room 14-2657B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	25	Square Feet	$50 - $125
		Space Removal Costs			$50 - $125

Location

Room 14-2657C

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Friable	White Sink Undercoating	15	14	Linear Feet	$140 - $350
Friable	White Sink Undercoating	16	14	Linear Feet	$140 - $350
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	64	Square Feet	$128 - $320
		Space Removal Costs			$408 - $1,020

Location

Room 14-2657D

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	15	Square Feet	$30 - $75
		Space Removal Costs			$30 - $75

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

Room 14-2657E

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	255	Square Feet	$510 - $1,125
		Space Removal Costs			$510 - $1,125

Location

Room 14-2657F

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	18	Square Feet	$36 - $90
		Space Removal Costs			$36 - $90

Location

Room 14-2657G

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	18	Square Feet	$36 - $90
		Space Removal Costs			$36 - $90

Location

Room 14-2657H

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	24	Square Feet	$48 - $120
		Space Removal Costs			$48 - $120

Location

Room 14-2657J

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	255	Square Feet	$510 - $1,125
		Space Removal Costs			$510 - $1,125

Location

Room 14-2657K

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	18	Square Feet	$36 - $90
		Space Removal Costs			$36 - $90

Location

Room 14-2657L

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	18	Square Feet	$36 - $90
		Space Removal Costs			$36 - $90

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

Room 14-2657M

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Friable	Silver Light Reflector Paper	13	1	Square Feet	$200
		Space Removal Costs			$200

Location

Room 14-2658

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Friable	Grey Mudded Fitting - Steam	8	4	Linear Feet	$40 - $100
		Space Removal Costs			$40 - $100

Location

Room 14-2S3

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9 x9 teal with white and dark teal smears Floor Tile & Mastic	26	10	Square Feet	$20 - $50
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	35	Square Feet	$70 - $175
		Space Removal Costs			$90 - $225

Location

Room 14-3650

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Friable	White Firring Steam	*38*	*3*	*Linear Feet*	$30 - $75
Friable	White Piping - Steam	*39*	*20*	*Linear Feet*	$200 - $500
Friable	Silver Light Reflector Paper	13	2	Square Feet	$200
Category I	9" x 9" Cream with rust and grey streaks Floor Tile & Mastic	35	1,380	Square Feet	$2,760 - $6,900
Category I	12" x 12" unkonw color floor tile floor tile & mastic	36	350	Square Feet	$700 - $1,750
		Space Removal Costs			$3,890 - $9,425

Location

Room 14-3651

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	White Floor Tile under Carpet	50	180	Square Feet	$360 - $900
		Space Removal Costs			$360 - $900

Location

Room 14-3651A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	White Floor Tile under Carpet	50	72	Square Feet	$144 - $360
		Space Removal Costs			$144 - $360

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

Room 14-3651C

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	White Floor Tile under Carpet	50	99	Square Feet	$198 - $495
		Space Removal Costs			$198 - $495

Location

Room 14-3651E

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	White Floor Tile under Carpet	50	90	Square Feet	$180 - $450
		Space Removal Costs			$180 - $450

Location

Room 14-3651G

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	White Floor Tile under Carpet	50	140	Square Feet	$280 - $700
		Space Removal Costs			$280 - $700

Location

Room 14-3653

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9" x 9" Beige Thin brown & cream streaks floor tile & mastic	25	32	Square Feet	$64 - $160
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	193	Square Feet	$386 - $965
Category I	9" x 9" Cream with rust and gray streaks floor tile & mastic	35	4	Square Feet	$8 - $20
		Space Removal Costs			$426 - $1,065

Location

Room 14-3653A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3653B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3654

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9 x9 teal with white and dark teal smears Floor Tile & Mastic	26	160	Square Feet	$320 - $800
		Space Removal Costs			$320 - $800

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

Room 14-3654A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9 x9 teal with white and dark teal smears Floor Tile & Mastic	26	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3654B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9 x9 teal with white and dark teal smears Floor Tile & Mastic	26	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3655

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	170	Square Feet	$340 - $850
		Space Removal Costs			$340 - $850

Location

Room 14-3655A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3655B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3656

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x 9 dark brown with yellow & white streaks floor tile & mastic	33	14	Square Feet	$28 - $70
		Space Removal Costs			$28 - $70

Location

Room 14-3657

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9 x9 teal with white and dark teal smears Floor Tile & Mastic	26	170	Square Feet	$340 - $850
		Space Removal Costs			$340 - $850

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

Room 14-3657A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9 x9 teal with white and dark teal smears Floor Tile & Mastic	26	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3657B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9 x9 teal with white and dark teal smears Floor Tile & Mastic	26	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3658

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	170	Square Feet	$340 - $850
		Space Removal Costs			$340 - $850

Location

Room 14-3658A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3658b

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3659

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x 9 dark brown with yellow & white streaks floor tile & mastic	33	14	Square Feet	$28 - $70
		Space Removal Costs			$28 - $70

Location

Room 14-3660

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	26	170	Square Feet	$340 - $850
		Space Removal Costs			$340 - $850

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

Room 14-3660A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	26	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3660B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	26	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-36661

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	170	Square Feet	$340 - $850
		Space Removal Costs			$340 - $850

Location

Room 14-36661A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-36661B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3662

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x 9 dark brown with yellow & white streaks floor tile & mastic	33	14	Square Feet	$28 - $70
		Space Removal Costs			$28 - $70

Location

Room 14-3663

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	26	170	Square Feet	$340 - $850
		Space Removal Costs			$340 - $850

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

Room 14-3663A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	26	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3663B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	26	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3664

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	170	Square Feet	$340 - $850
		Space Removal Costs			$340 - $850

Location

Room 14-3664

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
	No Access	71	1		
		Space Removal Costs			

Location

Room 14-3664B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3665

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x 9 dark brown with yellow & white streaks floor tile & mastic	33	14	Square Feet	$28 - $70
		Space Removal Costs			$28 - $70

Location

Room 14-3666

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	44	Square Feet	$88 - $220
		Space Removal Costs			$88 - $220

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

Room 14-3667

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	308	Square Feet	$616 - $1,540
		Space Removal Costs			$616 - $1,540

Location

Room 14-3667A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3667B

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	9	Square Feet	$18 - $45
		Space Removal Costs			$18 - $45

Location

Room 14-3667C

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Friable	Silver Light Reflector Paper	13	2	Square Feet	$200
		Space Removal Costs			$200

Location

Room 14-3668

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	221	Square Feet	$442 - $1,105
		Space Removal Costs			$442 - $1,105

Location

Room 14-3668A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	12	Square Feet	$24 - $60
		Space Removal Costs			$24 - $60

Location

Room 14-3H6A

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	816	Square Feet	$1,632 - $4080
		Space Removal Costs			$1,632 - $4080

Site Information

Missouri School for the Blind - Building 7 (Site ID: MSB)

Building: Building 14 East Wing

3815 Magnolia

St. Louis, MO 63110

Client Information

State of Missouri

301 W. High Street

Jefferson City, MO 65102

Location

Room 14-1652

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category II	Black Sink Undercoating	54	12	Each	$900 - $1,800
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	27	180	Square Feet	$360 - $900
		Space Removal Costs			$1,260 - $2,700

Location

Room 14-1653

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Friable	Black Sink Undercoating	62	80	Linear Feet	$800 - $2,000
Friable	Grey Pipe Elbows	63	6	Linear Feet	$60 - $150
		Space Removal Costs			$860 - $2,150

Location

Room 14-1653

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9" x 9" Beige with multi-colored streaks floor tile & mastic	58	60	Square Feet	$120 - $300
Category I	9" x 9" Burnt rust with red and white streaks floor tile & mastic	59	10	Square Feet	$20 - $50
		Space Removal Costs			$140 - $350

Location

Room 14-1S5

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	9x9 Tan with brown and cream streaks floor tile & mastic	12	88	Square Feet	$176 - $440
		Space Removal Costs			$176 - $440

Location

Exterior, South

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category II	White Window Caulking	67	584	Linear Feet	$1,168 - $2044
		Space Removal Costs			$1,168 - $2044

Location

Exterior, South

EPA Category	*Suspect Material*	*HM*	*QTY.*	*Units*	*Removal Costs (low to High)*
Category I	Roofing Material	69	11,160	Square Feet	$55,800 - $72,540
		Space Removal Costs			$55,800 - $72,540

Appendix A

Definitions of Terms and Assessment Criteria

Definitions of Terms and Assessment Criteria

This survey report organizes information on each suspect ACBM identified in tables located in Section 4. This section defines the terms used to describe materials listed in Section 4.

Material description contains the description of the suspect homogeneous asbestos containing building material.

Material Serial Number is used to reference the material for reinspections, etc.

Asbestos type and content describes the type of asbestos and its percentage in the material.

Asbestos Results for positive materials are shown as a percentage. Samples having less than 1% asbestos are reported as containing "Trace" amounts of asbestos and samples with no detected asbestos are reported as "BLD" or below limit if detection.

Sample number(s) identifies a particular material sample obtained form a specific sample location. Sample numbers are used primarily for laboratory identification.

Sample Location identifies where the samples of this material were obtained.

Material Category categorizes each material as surfacing, TSI or miscellaneous.
Surfacing Materials – Asbestos containing materials that are sprayed-on, trowled-on or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

Thermal Systems Insulation (TSI) – Asbestos containing materials applied to pipes, fittings, boilers, breaching, tanks, ducts or other interior structural components to prevent heat loss or gain or water condensation.

Miscellaneous Materials – Asbestos containing materials applied to or a part of building components that are not classified as surfacing materials or thermal systems insulation.

Presumed Asbestos Containing Material (PACM) – presumed because sampling would permanently damage the integrity of the component or is physically practical.

Quantity & Units reports approximate total quantity per unit of measure for each material.

Building(s) & Floor(s) specifies where a material is located.

Material Location describes where the material is found throughout the building.

Material Condition identifies the material as Friable, Non-friable or Jacketed (for thermal systems insulation only) if asbestos is present.

Friable – An asbestos containing material that can be crumbled, pulverized or reduced to powder, when dry, by hand pressure, such as spray applied fireproofing on structural steel members, spray applied acoustical ceiling materials or damaged thermal systems insulation. Friable materials are of greatest concern due to their potential fiber release.

Non-Friable – An asbestos containing material where the asbestos is bound tightly in a matrix or sealed by a protective layer. Non-friable materials can become friable by being rendered to a crumbled, pulverized or powdered state, when dry, by crushing, sanding, sawing, shot-blasting, severe weathering or by other mechanically induced means. Common examples of non-friable materials are adhesives, floor tiles, transite and roofing materials.

Jacketed – An asbestos containing material applied to thermal systems insulation and "jacketed" with a protective outer layer such as canvas or metal to keep the material in good condition. Undamaged jacketed ACBM is considered non-friable. If the jacketing is damaged, the material is considered friable.

Damage Category describes the type of damage, if any, to the material. The following damage categories are used: None, Physical, Air, and Water.

Material Assessment identifies the condition of the material in relation to physical and water damage, delamination of the material from its substrate, the extent of the damage and the potential for damage from building conditions, such as, accessibility by building occupants, influence of vibration, etc. The six standard assessment charges ranked by hazard potential, with the first being the lowest hazard are as follows: 1) Potential for Damage, 2) Potential for Significant Damage, 3) Damaged 4) Damaged with Potential for Damage, 5) Damaged with Potential for Significant Damage, and 6) Significantly Damaged. Only friable materials are assessed under AHERA regulations. Non-friable materials, unless damaged, are not assessed and can be assumed to be in good condition.

Damaged – The damage or deterioration of the material results in inadequate cohesion or adhesion with crumbling, blistering, water stains, marring or otherwise abraded over less than one-tenth (1/10) of the surface if the damage is evenly distributed or one-fourth (1/4) if the damage is localized.

Significant Damage – The damage or deterioration of the material results in inadequate adhesion or cohesion and the damage is extensive and severe with one or more of the following characteristics: 1) Crumbling or blistering over at least one-tenth (1/10) of the surface if evenly distributed, one-fourth (1/4) if the damage is localized; 2) Areas of the material hanging from the surface, delaminated, or showing adhesive failure; 3) Water stains, gouges or marred.

Recommended Response suggests the appropriate options for controlling or maintaining ACBM in a safe manner. There are four options used:
Operations and Maintenance (O & M) – A program designed to "manage" asbestos in-place. As long as asbestos containing materials remain in a building, an O & M program should be instituted to alert maintenance personnel, custodial workers and outside vendors of the existence and location of these materials and to set a policy for the maintenance of these materials. The material is usually only required

to be removed if it is significantly damaged, prior to demolition of the building or if it will be disturbed by renovation activities.

Repair – The restoration of damages or deteriorated asbestos containing building materials to an intact condition. Once the intact condition is established, the material should be included in an O & M program. The material is usually only required to be removed if it is significantly damaged, prior to demolition of the building or if it will be disturbed by renovation activities.

Abate Due to Condition – This material is significantly damaged and is unsafe in its current condition. The access to the area should be restricted to personnel equipped with appropriate personal protection. This material should be properly removed by a licensed contractor using workers trained in the safe removal of asbestos.

Abate Prior to Renovation – This material should be properly removed prior to planned renovation activities by a licensed contractor using workers trained in the safe removal of asbestos. This recommendation is usually made only on survey reports prepared prior to planned renovation activities.

Comments & Damage Description contains any additional information and or specific details of material damage are noted here.

EPA Category provides the appropriate material category as outlined in the NESHAPS regulation. The four options are friable, Category 1, Category 2, and needs determination.

Friable – Materials containing greater than 1% asbestos are always considered Regulated Asbestos Containing Materials (RACM) that require removal prior to building renovation or demolition activities that impact the material.

Category 1 – Materials that are bituminous non-friable and contain more than 1% asbestos that become RACM and require removal only when will be subject to grinding, cutting, sanding or abrading.

Category 2 – Materials that are non-friable and contain more than 1% asbestos that will have a high probability of being crumbled, pulverized or reduced to a powder by the demolition or renovation activity. These materials usually become RACM and will require removal.

Needs Determination – Materials that the individual designing the abatement and demolition project needs to inspect and evaluate to determine the potential for the material to become RACM and/or evaluate the asbestos content for the composite and individual layers of the material. For sheet rock with mudding compounds only, the EPA allows using the composite sample result. If the composite result by Point Counting the sample is below 1% asbestos, the material is not RACM.

Appendix B

Bulk Sampling Protocol and Analytical Methods

Bulk Sampling Protocol and Analytical Methods

Bulk samples of suspect asbestos containing building materials were obtained using standard industrial hygiene techniques including wetting friable materials to minimize friable release. When necessary, our personnel wore half-face air purifying respirators equipped with high efficiency particulate (HEPA) filters while obtaining samples.

Our sampling strategy for suspect friable surfacing materials was based on the guidelines outlined in the EPA publication "Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials," the procedures outlined in 40 CFR 763, Subpart E (AHERA). For non-friable suspect materials, AHERA requires the building inspector to determine the appropriate number of samples to obtain and analyze.

Samples with no observable asbestiform minerals are designated as Non-Detect (NAD). Samples in which asbestiform minerals are observed, but exist in concentrations of less than one percent (<1%), are designated as present in Trace (TR) amounts; all other samples are designated as asbestos containing with the appropriate percent of asbestos noted.

Each inspection was conducted by an accredited inspector who:

1. Visually inspected the area to identify the locations of suspected asbestos-containing building material (ACBM).

2. Touched all suspected ACBM to determine friability.

3. Identified all homogeneous areas of suspected friable and nonfriable ACBM.

4. Sampled each identified homogeneous area in accordance with 29 CFR 1910.1001 pursuant to the requirements of 40 CFR 763.86, or assumed the material to be an ACBM.

5. Assessed each identified homogeneous area in each functional space in accordance with 29 CFR 1910.1001 pursuant to the requirements of 40 CFR 763.88.

6. Recorded the following information:

a. The date of the inspection, the name and signature of the person(s) performing the inspection, and the inspector accreditation number.

b. An inventory of the locations of the homogeneous areas where samples were collected, exact location where each bulk sample was collected, dates that samples were collected, and homogeneous areas where suspected ACBM was assumed to be asbestos-containing material (ACM).

c. The name and signature of each inspector who collected the samples, and an accreditation number.

Appendix C

Laboratory Bulk Sampling Reports

Appendix D

TEM Laboratory Baseline Air Sampling Reports

Appendix E

Summary of Regulatory Requirements

Appendix E Summary of Regulatory Requirements
This appendix provides a summary of building owner and manager requirements under various asbestos regulations promulgated by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) to protect building occupants and employees from exposure to asbestos.

Survey Requirements
Prior to any renovation activity, OSHA and EPA regulations require that a complete asbestos survey be performed to determine if asbestos is present in any suspect asbestos containing material that will be present in the construction or work area. This survey report addresses accessible material. It is recommended that prior to renovation activities, inaccessible areas that could contain asbestos materials be inspected.

Notification and Posting Requirements
As required by the Occupational Safety and Health Act (OSHA) Asbestos Construction Standard, 29 CFR 1926.1101, all PACM and identified ACM must be included in your building notification statements for employees, tenants, and outside contractors, as well as any other affected parties to prevent exposure to asbestos.

All ACM should be properly labeled and easily identified as ACM. Warning signs should be posted at the entrance of mechanical rooms that contain asbestos.

Removal Requirements
Under EPA regulations, asbestos containing materials must be properly removed by licensed asbestos abatement contractors prior to renovation or demolition activities that would disturb friable materials or cause non-friable materials to become friable and a regulated material.

Repair of Damaged Materials and Cleanup of Debris
OSHA requires that asbestos containing debris be immediately cleaned up. It is recommended that damaged materials that may release fibers be repaired by properly trained personnel as soon as possible to prevent fiber release and potential exposures.

Training Requirements
OSHA requires employers whose employees are likely to or required to disturb asbestos to receive an asbestos training course. Refresher training is require to be provided annually.

Appendix F

Building Inspector Certifications

CERTIFICATION NUMBER:

7011011018MOII19584

THIS CERTIFIES

Clayton V Goth

HAS COMPLETED THE CERTIFICATION

REQUIREMENTS FOR

Inspector

APPROVED: **01/29/2018**

EXPIRES: **01/29/2019**

TRAINING DATE: **01/10/2018**

Kyra L Moore

Director of Air Pollution Control Program

Missouri Department of NATURAL RESOURCES
dnr.mo.gov
Eric R. Greitens, Governor
Carol S. Comer, Director

April 26, 2018

Justin E. Arnold
703 Tall Chief Street
Buckner, MO 64016

RE: **Missouri Asbestos Occupation Certification Card**

Enclosed is your certification card for Asbestos Management Planner, as issued by the Asbestos Unit of the Missouri Department of Natural Resources' Air Pollution Control Program.

Missouri Certification Number: 7011041218MOMPR13670
Course Training Date: April 12, 2018
Missouri Certification Approval Date: April 26, 2018
Missouri Certification Expiration Date: April 26, 2019

Note:

- All Missouri-certified asbestos personnel must comply with the following statutes and regulations:
  - Sections 643.225 to 643.225, 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

Recycled paper

Appendix G
O & M Plan (same plan is used for all schools)

ASBESTOS OPERATIONS AND MAINTENANCE PROGRAM (O&M PLAN)

Prepared for:

Division of Special Education
State Schools for Severely Handicapped (SSSH)
Missouri School for the Blind (MSB)
Missouri School for the Deaf (MSB)

Missouri Department of
Elementary and Secondary Education

205 Jefferson Street
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OCCU-TEC
SAFETY AND ENVIRONMENTAL SOLUTIONS

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May 15, 2008

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1.0 OBJECTIVES

In accordance with the requirements of the U.S. Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and local authorities, The Department of Elementary and Secondary Education (DESE) has developed and implemented this Asbestos Operations and Maintenance (O&M) Plan for DESE school facilities located throughout the State of Missouri. The primary objective of the Asbestos Operations and Maintenance (O&M) Plan is to recognize, control, and mitigate potential asbestos hazards exposure to student, parent, staff, and contractors utilizing DESE school facilities. The secondary objectives of the O&M Plan include: 1) the in-place maintenance of asbestos containing material (ACM) until it is to be removed; 2) the minimization of potential release of asbestos fibers during cleaning, maintenance, renovation, and general school operation activities; and 3) the removal of deteriorated ACM that is beyond the scope of normal maintenance or repair activities.

2.0 INTRODUCTION

Asbestos Inspection data provided by OCCU-TEC Inc. and Jurgiel & Associates Inc. was used as a reference in the generation of this Operation and Maintenance (O&M) Plan. To help protect students and workers at 38 DESE school sites located throughout the State of Missouri, OCCU-TEC Inc. has produced this (O&M) plan for ACMs known to be present in the DESE school facilities. This O&M plan should only be used by properly trained state personnel and contract workers. Training requirements are summarized in Section 4.2.

3.0 SURVEY FINDINGS

Previous and recent inspections of DESE facilities have identified both friable and non-friable asbestos containing materials. Asbestos containing material (ACM), is defined by the EPA and OSHA as a material which contains a measurable asbestos content of greater than one percent (>1%.).

Friable asbestos containing materials are defined as a material that when dry may be crumbled, pulverized, or reduced to powder by hand pressure. Friable asbestos containing material can include previously non-friable material after such material has become damaged to the extent that when dry, it may be crumbled, pulverized, or reduced to powder by hand pressure.

4.0 PLAN COMPONENTS

The work practices described in this plan are applicable to repair, maintenance and cleaning operations where friable or nonfriable ACM or presumed asbestos-containing material (PACM), are involved. The work practices are intended to assist state personnel meet EPA worker protection rules and contract workers meet Occupational Safety and Health Administration (OSHA) regulations applicable to O&M work. DESE will maintain the O&M Plan for all school facilities and coordinate any cleaning, maintenance, renovation, and abatement of asbestos located inside the school facilities.

4.1 TRAINING

Proper worker training is a vital element in worker protection. The work practices described in this plan should be implemented in conjunction with proper worker training. EPA Asbestos Worker Protection Rules [40 CFR Part 763, Subpart G], EPA Asbestos Model Accreditation Plan [40 CFR 763], OSHA Construction Standard [Title 29, CFR 1926.1101], and OSHA General Industry Standard [Title 29, CFR 1910.1001] require various levels of training depending on the work practices involved; and cross-reference each other in specifying training requirements. In general, the requirements outlined in the EPA Asbestos Model Accreditation Plan provide the type, duration, and topics to be covered for various classes of training. The following is a list of pertinent training that state workers or contractors should receive prior to performing work that may disturb ACM.

- **Asbestos Contractor/Supervisor**: Personnel who supervise Class I and II asbestos work must complete 40 hours of asbestos contractor/supervisor training. Eight hour refresher course is required annually for certification to be maintained.

- **Asbestos Abatement Worker**: Thirty-two hours of training must be completed by personnel who perform Class I, and in some circumstances, Class II asbestos work. Class I and II asbestos work includes removal or encapsulation of ACM where the sole intent of a project being performed is to abate asbestos. Eight hour refresher course is required annually to maintain certification.

- **Operations and Maintenance**: Sixteen hours of training shall be completed by personnel who perform Class III asbestos work. Annual refresher training is required, but no minimum number of hours is specified. The "competent person" determines the level of training required for personnel performing O&M work. A competent person is defined by OSHA as “one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f): in addition, for Class I and Class II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor, or its equivalent and, for Class III and Class IV work, who is trained in a manner consistent with EPA requirements for training of local education agency maintenance and custodial staff as set forth at 40 CFR 763.92 (a)(2).”
- **General Awareness**: Two hours of training must be completed by personnel who perform Class IV asbestos work and maintenance and custodial staff who work in buildings containing ACM.

The amount and content of worker training must meet OSHA and EPA minimum requirements. General subject areas that all O&M training should include… personal protective equipment and respirator training where applicable; health risks associated with asbestos exposures; and the importance of carefully adhering to building O&M programs.

The 16-hour Operations & Maintenance training should emphasize hands-on removal, maintenance, and repair methods. The workers should learn how to use the O&M plan, how to perform specific tasks including glovebag removal methods and constructing negative pressure mini-enclosures.

4.2 NOTIFICATION

As required by OSHA, DESE must make notification to the following personnel about the presence, location and quantity of ACM or PACM:

- Employees
- Prospective employees, vendors, and contractors applying for or bidding for work

This notification is required if employees or contractors will be performing work in or adjacent to areas where ACM or PACM is located. Asbestos warning labels should be visible in mechanical spaces such as boiler rooms and pipe chases. The building owner shall post signs that identify the material that is present, its location, and appropriate work practices which, if followed, will ensure that ACM will not be disturbed. The employer shall ensure, to the extent feasible, that employees who come in contact with these signs can comprehend them. Means to ensure employee comprehension may include the use of foreign languages, pictographs, and graphics. Missing or worn-out labels should be replaced, as needed. As the ACM is abated and new non-ACM material is installed, replacement material should be labeled as non-ACM. This assures that all workers are aware that the new material does not contain asbestos.

4.2.1 Employees

DESE must notify affected employees of the existence of ACM that they could potentially disturb during the course of their employment. Notification could be made to employees by utilizing notification forms as contained in Appendix A. The obligation to notify extends beyond those employed by the owner and includes anyone who may disturb or contact these materials. Maintenance workers (whether directly employed by the owner or by a maintenance contractor), building occupants, contractors, and those working for contractors are all included.

All maintenance workers must be advised and trained in the proper procedures to follow when their work involves possible contact with ACM. The information given to employees and occupants must contain the following:

- The location and condition of the ACM in their area.
- Do not disturb ACM(s).
- Report any change of condition, evidence of disturbance (such as dust or debris), or damage of ACM to supervisor or management.
- A statement that the mere presence of ACM does not present a health hazard; Asbestos is a potential health hazard when fibers become airborne and are inhaled.
- A statement that cleaning and maintenance personnel must take special precautions to guard against disturbing ACM.
- A statement indicating that ACM is inspected periodically and additional measures taken, if needed, to protect the health of building occupants/employees.

DESE limits its trained maintenance staff to small quantity, short-duration repair and O&M work. In general, in-house personnel are limited to those activities that can be performed without entering into an environment where there is an elevated level of airborne asbestos. If there has been an episode where ACM has been released into the building environment, employees must be instructed to notify the appropriate personnel immediately to insure the appropriate response can be implemented. Any air monitoring results must be shared with the occupants and employees.

4.2.2 Contractors

The asbestos O&M program includes control over contracted services as described below.

Custodial work: Contractors involved in cleaning and other custodial services which are in the vicinity, but do not disturb, asbestos-containing installations, debris, or dust must be notified of the location of ACM by DESE utilizing the Contractor's Acknowledgement Form or similar form found in Appendix B. This Acknowledgement Form should be signed by the contractor who employs the workers and then returned to DESE for documentation of the notification.

Repair and maintenance: Repair or maintenance in controlled areas or on controlled systems where asbestos may be disturbed require specific work procedures using trained workers. Specifications for ACM removal should be made a part of a set of contract documents.

DESE is responsible for notifying any contractor working onsite of asbestos hazards; the contractor is responsible for notifying his employees. This could be accomplished by utilizing the form in Appendix B. The contractor must be held responsible for performing his work without disturbing any remaining asbestos identified in surveys, drawings, or specifications.

4.3 RESPIRATORY PROTECTION

Respiratory protection is required under OSHA 1926.1101 anytime:

- Class I asbestos work is undertaken
- Class II asbestos work is undertaken where the ACM is not removed in a substantially intact state.
- Class II and III asbestos work which is not performed using wet methods. An example of this would be working around live electrical outlets.
- Class II and III asbestos work for which a "negative exposure assessment" hasn't been conducted.
- Class III asbestos work when TSI or surfacing ACM or PACM is being disturbed.
- Class IV asbestos work performed in regulated areas where employees performing asbestos work are required to use respirators.
- If respiratory protection is required, DESE must implement a respiratory protection program in accordance OSHA Construction Standard [29 CFR 1926.1101] and Asbestos Worker Protection Rules [40 CFR Part 763, Subpart G].

No employee shall be assigned to asbestos work that requires respirator use if, based on their most recent medical examination, the examining physician determines that the employee will be unable to function normally while using a respirator, or that the safety or health of the employee or other employees will be impaired by the employee's respirator use. Such employees must be assigned to another job or given the opportunity to transfer to a different position that they can perform. For a transfer to occur, it must be with the same employer, in the same geographic area, and with the same seniority, status, rate of pay, and other job benefits the employee had just prior to such transfer.

4.3.1 **Respirator Selection.**

1. The employer shall select the appropriate respirator as specified in the table below.

TABLE 1
RESPIRATORY PROTECTION FOR ASBESTOS FIBERS

AIRBORNE CONCENTRATION OF ASBESTOS OR CONDITION OF USE	REQUIRED RESPIRATOR
Not in excess of 1 f/cc (10 X PEL), or otherwise as required independent of exposure pursuant to (h)(2)(D)of this section.	Half-mask air purifying respirator other than a disposable respirator, equipped with high efficiency filters.
Not in excess of 5 f/cc (50 X PEL).	Full facepiece air-purifying respirator equipped with high efficiency filters.
Not in excess of 10 f/cc (100 X PEL).	Any powered air-purifying respirator equipped with high efficiency filters or any supplied air respirator operated in continuous flow mode.
Not in excess of 100 f/cc (1,000 X PEL).	Full facepiece supplied air respirator operated in pressure demand mode.
Greater than 100 f/cc (1,000 X PEL) concentration.	Full facepiece supplied air or unknown respirator operated in pressure demand mode, equipped with an auxiliary positive pressure self-contained breathing apparatus.

Note: a. Respirators assigned for high environmental concentrations may be used at lower concentrations, or when required respirator use is independent of concentration.

Note: b. A high efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter or larger.

2. The employer shall provide a tight fitting powered, air- purifying respirator in lieu of any negative-pressure respirator specified in the table above whenever:
   a. An employee chooses to use this type of respirator; and
   b. This respirator will provide adequate protection to the employee.

4.4 MEDICAL EXAMINATIONS

DESE shall ensure that all medical examinations and procedures are performed by a licensed physician, and are provided at no cost to the employee and at a reasonable time and place.

The employer shall make available medical examinations and consultations to each employee covered under 29 CFR 1926.1101 on the following schedules:

Prior to assignment of the employee to an area where negative- pressure respirators are worn;

When the employee is assigned to an area where exposure to asbestos may be at or above the permissible exposure limit for 30 or more days per year, or for employees who engage in Class I, II or III work for a combined total of 30 or more days per year. For either situation, a medical examination must be given within 10 working days following the thirtieth day of exposure. A medical examination must be provided at least annually thereafter.

If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies specified by the physician. DESE shall provide a medical examination at the termination of employment for any employee who has been exposed to airborne concentrations of asbestos at or above the permissible exposure limit and/or excursion limit. The medical examination shall be given within 30 calendar days before or after the date of termination of employment.

4.5 PERSONAL PROTECTIVE EQUIPMENT

1. DESE shall provide or require the use of protective clothing, such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos that exceed the TWA and/or excursion limit prescribed in 29 CFR 1926.1101. The above statement also applies to all employees for whom a required negative exposure assessment has not been produced, and for any employee performing Class I operations which involve the removal of > 25 linear or 10 square feet of TSI or surfacing ACM or PACM.

2. DESE shall prohibit the removal of asbestos from protective clothing and equipment by blowing, shaking, or brushing.

3. Laundering.
   a. The employer shall ensure that laundering of contaminated clothing so as to prevent release of airborne asbestos in excess of the TWA or excursion limit prescribed in 29 CFR 1926.1101.
   b. Any employer who gives contaminated clothing to another person for laundering shall inform such person of the contamination to avoid the release of airborne asbestos in excess of the TWA and excursion limit prescribed in 29 CFR 1926.1101.
   c. Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and be labeled in accordance with 29 CFR 1926.1101.

4. Inspection of protective clothing.
   a. The competent person shall examine worksuits worn by employees at least once per workshift for rips or tears that may occur during performance of work.
   b. When rips or tears are detected while an employee is working, rips and tears shall be immediately mended, or the worksuit shall be immediately replaced.

4.6 WORK PRACTICES

This section briefly describes the OSHA classifications of asbestos work. In addition, a discussion is presented outlining the steps necessary to ensure that safe work practices are properly implemented.

The OSHA Construction Standard [Title 29, CFR Part 1926.1101] provides detailed work practice and engineering control requirements based on four classifications of asbestos work. In general, Class I work poses the greatest risk and Class IV poses the least. The classes are summarized below:

- **Class I**: Activities involving the removal of thermal system insulation (TSI) and sprayed-on, troweled-on, or otherwise applied surfacing ACM and PACM applied to pipes and boilers. Class I work is generally accomplished by licensed, professional asbestos abatement contractors.

- **Class II**: Activities involving the removal of asbestos-containing floor tile and associated mastics, wallboard, joint compounds, sheet flooring, roofing, transite, gaskets, and similar materials.

- **Class III**: Repair and maintenance operations where ACM (including TSI and surfacing ACM and PACM) are likely to be disturbed. Examples of Class III asbestos work include disturbance and repair of small amounts of pipe insulation in the course of repairing a leaking valve; removal of small amounts of an ACM wall to repair electrical wiring; and removal of floor tile and mastic loosened by water damage.

- **Class IV**: Custodial, maintenance, and construction activities during which employees contact, but do not disturb ACM or PACM; this also include activities to clean up waste and debris that may contain ACM or PACM. Examples include cleaning ACM floors, working around electrical and HVAC equipment; and dusting/vacuuming in areas where ACM pipe insulation is present.

Each ACM identified warrants a specific work practice to control exposure. These work practices include routine maintenance, patch and repair, encapsulation, enclosure, and removal. Any of these work practices may disturb or dislodge ACM or render the material friable and, therefore, safe work practices must be followed. The applicable regulations that outline such safe work practices and abatement strategies can be found in the following regulations:

Worker Protection Standards, Construction Industry	OSHA 29 CFR 1926.1101
Worker Protection Standards, General Industry	OSHA 29 CFR 1910.1001
Federal Asbestos Abatement Regulations	EPA NESHAP 40 CFR 61 Subpart M
Federal Asbestos Regulations	EPA AHERA 40 CFR Part 763
Asbestos Worker Protection Rule	EPA AHERA 40 CFR Part 763, Subpart G

These regulations combined with the OSHA and EPA mandated training, are designed to protect workers and control the disturbance/release of airborne asbestos, materials, and debris.

4.6.1 Class I Removal Work (Pipe Insulation, Pipe Fittings, Tank Insulation, Boiler Insulation, Fireproofing, etc.)

It is recommended that this type of asbestos removal work be contracted out to professional, licensed asbestos abatement contractors.

4.6.2 Class II Removal Work (Floor Tile and Mastics, Wallboard and Joint Compounds, Sheet Flooring, Roofing, Transite and Gaskets, etc.)

It is recommended that this type of work by conducted by 32-hour trained personnel overseen by a 40-hour trained supervisor.

The following are general requirements for the removal of these materials:
1. Supervision by a Competent Person as defined by OSHA.
2. Critical barriers covering all openings in the regulated area.
3. Polyethylene sheeting (6-mil) covering all surfaces beneath the removal area.
4. HEPA filtration with local exhaust to the building exterior.
5. Enclosure or isolation of the work area.
6. Wet removal methods wherever feasible.
7. Removal by non-aggressive (non-mechanical) means.
8. Waste double-bagged in 6-mil polyethylene sheeting and labeled with Generator and DOT labels.

4.6.3 Class III Removal Work - Small-Scale, Short-Duration Operations Maintenance and Repair (O&M) Activities.

This work must be conducted by personnel with a minimum of 16-hour O&M training. Small-scale, short-duration is generally defined as removal of a quantity of ACM equal to or less than that which can be removed with a single glovebag, or, 3 square feet, 3 lineal feet.

Small-scale, short-duration renovation and maintenance activities are tasks such as, but not limited to:
- Removal of small quantities of asbestos-containing insulation on pipes or tanks;
- Removal of small quantities of asbestos-containing fireproofing on beams or above ceilings;
- Replacement of an asbestos-containing gasket on a valve;
- Installation or removal of a small section of drywall;
- Installation of electrical conduits through or in close proximity to ACM.
- Installation or removal of a small section of floor tile and mastic.
- Maintenance on asbestos-containing or presumed asbestos-containing fire doors.

Refer to Section 4.7 for procedures for Class III O&M activities.

4.6.4 Class IV Removal Work - Maintenance and custodial construction activities during which employees contact, but do not disturb ACM or PACM.

1. This work shall be conducted by employees trained to the asbestos awareness level or greater.

2. Employees who clean up debris shall assume the debris contains asbestos if the debris is located in areas of accessible thermal system insulation and/or surfacing material. All clean up of debris containing or presumed as ACM, shall be done promptly using wet methods and HEPA vacuums.

3. Employees cleaning up debris and waste in a regulated area where respirators are required shall wear respirators which are selected based upon hazard level, used, and fitted in accordance with OSHA and NIOSH.

4.6.4.1 Procedures for the Maintenance of Asbestos Containing Floor Tile

1. All floor tiles, 9"x 9" and 12"x 12", must be assumed to be asbestos containing unless proven otherwise. Only if testing has determined floor tiles to be non-asbestos containing may they be handled by non-certified persons.

2. Under no circumstances should broken or crumbled asbestos tiles be swept or cleaned up by non-certified maintenance or custodial persons. The Asbestos Program Manager should be contacted to arrange for the cleanup of any asbestos containing tile.

3. There is generally not a hazard associated with asbestos containing tile that is cracked as long as it is still properly adhered to the floor. However, the condition of cracked asbestos containing tile should be monitored closely.

4. If asbestos containing tiles are delaminating or are loose, they may be re-glued. Depending on the situation and condition of the tile, tiles needing to be removed/disposed of should be handled by asbestos certified personnel.

5. No buffing shall be performed on asbestos containing tiles that have not been sealed or finished in some manner. Dry buffing shall be performed only after sufficient coats of sealer or finish have been applied to protect the tile from being disturbed. Use the least abrasive pad possible to protect against breaking through the finish and disturbing the surface of the tile.

6. If during buffing, asbestos floor tile is dislodged or broken, stop work and contact the Asbestos Program Manager immediately to schedule the proper clean up of the tile.

7. Stripping of asbestos floor tile shall be done wet. At no time will dry stripping be allowed. If during the stripping procedure the asbestos containing tiles become dislodged, stop the procedure and notify the Asbestos Program Manager immediately.

8. During buffing or stripping of asbestos floor tiles, the least abrasive pad should be used at a speed of no greater than 300 rpm.

4.7 PROCEDURES FOR CLASS III O&M ACTIVITIES

1. The first step in preparing to perform a small-scale, short-duration O&M task, regardless of the method that will be used, is the removal of all movable objects from the work area to protect them from asbestos contamination. If objects have already been contaminated, they should be thoroughly cleaned with a HEPA filtered vacuum or be wet-wiped before they are removed from the work area. Objects that cannot be removed should be thoroughly cleaned with a HEPA filtered vacuum or be wet-wiped and covered completely with 6-mil-thick polyethylene plastic sheeting before the task begins.

2. Critical barriers covering all openings in the regulated area.

3. Polyethylene sheeting (6-mil) covering all surfaces beneath the removal area.

4. HEPA filtration with local exhaust to the building exterior if feasible. If using a mini-containment, a hepa-vacuum may be adequate to supply negative pressure.

5. Enclosure or isolation of the work area.

6. The work shall be performed using wet methods.

7. Where the disturbance involves drilling, cutting, abrading, sanding, chipping, breaking, or sawing of thermal system insulation or surfacing material, the employer shall use impermeable dropcloths, and shall isolate the operation using mini-enclosures or glove bag systems or another isolation method.

8. Employees performing Class III jobs shall wear respirators which are selected based upon hazard level, and used, fitted in accordance with OSHA and NIOSH, whenever there is disturbance of thermal system insulation or surfacing material, or where the employer does not produce a "negative exposure assessment" or where monitoring results show a PEL has been exceeded,

4.7.1 Wet methods

Whenever feasible, and regardless of the abatement method to be used (e.g., removal, enclosure, use of glove bags), wet methods must be used during small-scale, short-duration maintenance and renovation activities that involve disturbing ACM. Handling asbestos materials wet is one of the most reliable methods of minimizing the potential for asbestos fibers to become airborne. Wet methods can be used in the great majority of workplace situations. Only in cases where asbestos work must be performed on live electrical equipment, on live steam lines, or in other areas where water will seriously damage materials or equipment may dry removal be performed. Amended water or another wetting agent should be applied by means of an airless sprayer to minimize the extent to which the ACM is disturbed. ACM should be wetted at the initiation of the maintenance or renovation operation, and continually throughout the work period to ensure that any dry ACM exposed in the course of the work remains wet until final disposal.

4.7.2 Removal or repair of small quantities of ACM.

Several methods can be used to remove or repair small amounts of ACM during O&M tasks. These include the use of glove bags and the construction of mini-enclosures. The procedures that employers must use for each of these operations are described in the following sections.

4.7.3 Glove bags

Glove bags for O&M activities are approximately 40-inch-wide by 64-inch-long bags fitted with arms through which the work can be performed. When properly installed and used, they permit workers to remain completely isolated from the asbestos material being removed inside the bag. Glove bags can thus provide a flexible, easily installed, and quickly dismantled temporary small work area enclosure that is ideal for small-scale asbestos renovation or maintenance jobs. These bags are single-use control devices that are disposed of at the end of each task. The bags are made of transparent 6-mil polyethylene plastic with arms of spun-bonded polyolefin material (the same material used to make the disposable protective suits used in major asbestos removal operations and in protective gloves). Glove bags are readily available from safety supply stores or specialty asbestos removal supply houses. Glove bags come pre-labeled with the asbestos warning labels required by OSHA, Department of Transportation (DOT), and EPA for bags used to transport and dispose of asbestos waste.

Supplies and materials that are necessary for the use of glove bags include:

- Tape to seal glove bag to the area from which asbestos is to be removed.
- Amended water (water with an added surfactant) or other wetting materials.
- An airless sprayer for the application of amended water.
- Bridging encapsulant (a paste-like substance for coating asbestos) to seal the rough edges of any ACM that remains within the glove bag at the points of attachment after the rest of the asbestos has been removed.
- Tools such as razor knives, nips, and wire brushes (or other tools suitable for cutting wires, etc.).
- A HEPA filter-equipped vacuum for evacuating the glove bag (to minimize the release of asbestos fibers) during removal of the bag from the work area and for cleaning any material that may have escaped during the installation of the glove bag.
- HEPA filtered or more protective respirators for use by the employees involved in the removal of asbestos with the glove bag.

Glove bag work practices.

The proper use of glove bags requires the following steps:

1. Glove bags must be installed so that they completely cover the pipe or other structure where asbestos work is to be done. Glove bags are installed by cutting the sides of the glove bag to fit the size of the pipe from which asbestos is to be removed. The glove bag is attached to the pipe by folding the open edges together and securely sealing them with tape. All openings in the glove bag must be sealed with duct tape or equivalent material.

2. The employee performing the asbestos removal with the glove bag must don at least a half face HEPA-equipped respirator. Respirators must be worn by employees who are in close contact with the glove bag and who may thus be exposed as a result of small gaps in the seams of the bag or holes punched through the bag by a razor knife or a piece of wire mesh.

3. The removed asbestos material from the pipe or other surface must be adequately wetted with amended water applied with an airless sprayer through the precut port provided in most glovebags or applied through a small hole in the bag.

4. Once the asbestos material has been adequately wetted, it can be removed from the pipe, beam, or other surface. The tool used to remove the ACM depends on the type of material to be removed. ACM is generally covered with painted canvas and/or wire mesh. Painted canvas can be cut with a razor knife and peeled away from the ACM underneath. Once the canvas has been peeled away, the ACM underneath may be dry, in which case it should be re-sprayed with amended water to ensure that it generates as little dust as possible when removed. If the ACM is covered with wire mesh, the mesh should be cut with nips, tin snips, or other appropriate tool and removed. Amended water must then be used to spray any layer of dry material that is exposed beneath the mesh, the surface of the stripped underlying structure, and the inside of the glove bag.

5. After removing the layer of ACM, the pipe or surface from which asbestos has been removed must be thoroughly cleaned with a brush and wet-wiped with amended water until no traces of the ACM can be seen.

6. Any asbestos-containing insulation edges that have been exposed as a result of the removal or maintenance activity must be encapsulated with bridging encapsulant to ensure that the edges do not release asbestos fibers to the atmosphere after the glove bag has been removed.

7. When the asbestos removal and encapsulation have been completed, a vacuum hose from a HEPA-filtered vacuum must be inserted into the glove bag through the port to remove any air in the bag that may contain asbestos fibers. When the air has been removed from the bag, the bag should be squeezed tightly (as close to the top as possible), twisted, and sealed with tape, to keep the removed materials safely in the bottom of the bag. The HEPA vacuum can then be removed from the bag and the glove bag itself can be removed from the work area to be disposed of properly.

4.7.4 Mini-Enclosures

In some instances a glove bag may not be either large enough or the proper shape to enclose the work area. In such cases, a mini-enclosure can be built around the area where small-scale, short-duration asbestos maintenance or renovation work is to be performed. Such enclosures should be constructed of 6-mil polyethylene plastic sheeting and be small enough to restrict entry to the asbestos work area to one worker.

For example, a mini-enclosure can be built in a small utility closet when asbestos-containing drywall or drywall joint compound is to be removed. The enclosure is constructed by:

1. Affixing 6-mil polyethylene sheeting to the walls with spray adhesive and tape.

2. Covering the floor with 6-mil polyethylene sheeting and sealing the plastic covering the floor to the outside of the plastic on the walls.

3. Sealing any penetrations such as pipes or electrical conduits with tape; and using a HEPA vacuum to maintain negative pressure inside the work area.

4. Constructing a small change room (approximately 3 feet square) made of 6-mil polyethylene plastic supported by 2-inch by 4-inch lumber (the plastic should be attached to the lumber supports with staples or spray adhesive and tape). The change room should be contiguous to the mini-enclosure, and is necessary to allow the worker to vacuum off his protective coveralls and remove them before leaving the work area. While inside mini-enclosure, the worker should wear spun-bonded polyolefin disposable coveralls and use the appropriate HEPA-filtered or more protective respiratory protection.

The advantages of mini-enclosures are that they limit the spread of asbestos contamination, reduce the potential exposure of bystanders and other workers who may be working in adjacent areas, and are quick and easy to install. The disadvantage of mini-enclosures is that they may be too small to contain the equipment necessary to create a negative pressure within the enclosure; however, the double layer of plastic sheeting will serve to restrict the release of asbestos fibers to the area outside the enclosure.

4.7.5 Removal of small quantities of asbestos insulated pipes or structures

When pipes are insulated with ACM, removal of the entire pipe may be more protective, easier, and more cost effective than stripping the asbestos insulation from the pipe. Before such a pipe is cut, the asbestos-containing insulation must be wrapped with 6-mil polyethylene plastic and securely sealed with duct tape or equivalent. This plastic covering will prevent asbestos fibers from becoming airborne as a result of the vibration created by the power saws used to cut the pipe. If possible, the pipes should be cut at locations that are not insulated to avoid disturbing the asbestos. If a pipe is completely insulated with ACM, small sections should be stripped using the glove-bag method described above before the pipe is cut at the stripped sections.

4.7.6 Enclosure of ACM

The decision to enclose rather than remove ACM from an area depends on the employer's preference. Employers consider factors such as cost effectiveness, the physical configuration of the work area, and the amount of traffic in the area when determining which abatement method to use. If enclosure is chosen over removal, a solid structure with airtight walls and ceilings must be built around the ACM or structure to prevent the release of asbestos fibers into the area beyond the enclosure and to prevent the disturbance of these materials by casual contact during future maintenance operations.

Such a permanent (i.e., for the life of the building) enclosure should be built of non-asbestos new construction materials and be impact resistant and airtight. Enclosure walls should be made of tongue-and-groove boards, boards with spine joints, or gypsum boards having taped seams. The underlying structure must be able to support the weight of the enclosure. (Suspended ceilings with laid-in panels do not provide airtight enclosures and should not be used to enclose structures covered with ACM). All joints between the walls and ceiling of the enclosure should be caulked to prevent the escape of asbestos fibers. During the installation of enclosures, tools that are used (such as drills or rivet tools) should be equipped with HEPA-filtered vacuums. Before constructing the enclosure, all electrical conduits, telephone lines, recessed lights, and pipes in the area to be enclosed should be moved to ensure that the enclosure would not have to be re-opened later for routine or emergency maintenance. If such lights or other equipment cannot be moved to a new location for logistic reasons, or if moving them will disturb the ACM, removal rather than enclosure of the ACM is the appropriate control method to use.

4.7.7 Maintenance program for ACM

An asbestos maintenance program must be initiated in all facilities that have ACM. Such a program should include:

- Development of an inventory of all ACM in the facility.
- Periodic examination of all ACM to detect deterioration.
- Written procedures for handling ACM during the performance of small-scale, short-duration maintenance and renovation activities.
- Written procedures for asbestos disposal.
- Written procedures for dealing with asbestos-related emergencies.
- Training of staff in safe work procedures.

4.7.8 Maintenance program for Fire Doors

These procedures provide general guidance for the maintenance of presumed asbestos-containing fire doors.

1. Compliance with OSHA, State of Missouri, and EPA-AHERA regulations require that comprehensive asbestos inspections be completed prior to any renovation or demolition

activities in order to protect occupant and worker health. Any service to a presumed asbestos-containing fire door that could potentially disturb the core (i.e. drilling or cutting into the core,) qualifies as repair or maintenance and requires characterization for the presence of asbestos.

2. In order to comply with the above referenced regulations, State employees (i.e custodians, locksmiths, etc.) or outside contractors will not conduct any activity on presumed fire doors that involves drilling, cutting, abrading, or any other disturbance of the core until the presence or absence of asbestos can be verified.

3. The presence of asbestos cannot be verified by the appearance of the door, nor does the age of the door necessarily indicate whether the door contains asbestos. In the event that a suspect fire door must be serviced and that service may disturb the core of the door, one of the following steps should be followed:

   a) Presume that the door contains asbestos.
   b) Examine the plate or label on the door spine. The door core material may be listed on this plate. The information on the plated may be used to confirm the presence of asbestos, but the plate alone is not sufficient to determine that asbestos is not present.
   c) Contact the manufacturer for information on materials used for construction.
   d) Have a licensed asbestos inspector sample the door core material in an appropriate manner for the presence of asbestos.

4. If the doors are asbestos-containing or presumed to contain asbestos, the removal of the door must be conducted by a qualified abatement contractor. Doors containing asbestos or presumed to contain asbestos must be disposed of in an appropriate MDNR approved landfill, and cannot be disposed of as normal waste.

5. If DESE personnel intend to service asbestos-containing or presumed asbestos-containing fire doors, this would be considered a Class III work activity, requiring 16 hours of O&M training, proper equipment, proper PPE (personal protective equipment), and disposal.

4.8 PROHIBITED ACTIVITIES

The training program for the maintenance and custodial staff should describe methods of handling ACM as well as routine maintenance activities that are prohibited when ACM is involved.

For example, DESE maintenance staff employees should be instructed:

- Not to drill holes in ACM.
- Not to hang plants or pictures on structures covered with ACM.
- Not to sand ACM including floor tile. Stripping of floor tile finishes shall be conducted using low abrasion pads at speeds lower than 300 rpm with wet methods.
- Not to damage ACM while moving furniture or other objects.

- Not to install curtains, drapes, or dividers in such a way that they damage ACM.
- Not to dust floors, ceilings, moldings or other surfaces in asbestos-contaminated environments with a dry brush or sweep with a dry broom.
- Not to use an ordinary vacuum to clean up asbestos-containing debris.
- Not to remove ceiling tiles from below ACM without the use of proper respiratory protection, clearing the area of other people, and observing asbestos removal waste disposal procedures.
- Not to remove contaminated ventilation filters dry.
- Not to shake ventilation filters that are contaminated with ACM.

4.9 REMOVAL PROCEDURES FOR SPECIFIC MATERIALS

4.9.1 For Non-friable Flooring Materials

The following procedures shall be used to remove ACM flooring materials:

1. Isolate or shut down, lock-out and tag-out HVAC system (and other building systems that may create a hazard during the removal activity) in compliance with all local, state, and federal regulations and as specified in the Specification/Work Plan.
2. Regulate and isolate the work area with warning signs, barrier tape, and critical barriers in compliance with all local, state, and federal regulations and as specified in the Specification/Work Plan.
3. Upon approval of the work site preparation by consultant or delegated authority, contractor may proceed to remove the material using the below listed procedures.
4. Place tools, equipment and materials needed in work area.
5. Spray amended water ACM prior to start of removal.
6. Do not cut, abrade, or break ACM.
7. Dry sweeping is prohibited.
8. All scraping of residual adhesive and/or backing shall be performed using wet methods.
9. Removal of flooring by mechanical means is prohibited.
10. Tiles shall be removed intact, unless intact removal is not possible.
11. When tiles are heated and can be removed intact, wetting may be omitted
12. Do not allow ACM to drop from elevated heights. Always carry disposal bag to the ground; do not drop.
13. If material can cut through the disposal bags, place ACM into one 6 mil bag and then into barrels for fiber drums.
14. Clean up any debris or dust using HEPA vacuuming and wet wiping.

15. Notify consultant or delegated authority that work is complete so that a visual inspection and any clearance air monitoring can be conducted.
16. Upon passage of the visual inspection and clearance air monitoring (if conducted), warning signs, barrier tape, and critical barriers may be removed.

4.9.2 For Miscellaneous Non-Friable Materials

The following procedures shall be used to remove other non-friable ACM:

1. Isolate or shut down, lock-out and tag-out HVAC system (and other building systems that may create a hazard during the removal activity) in compliance with all local, state, and federal regulations and as specified in the Specification/Work Plan.
2. Regulate and isolate the work area with warning signs, barrier tape, and critical barriers in compliance with all local, state, and federal regulations and as specified in the Specification/Work Plan.
3. Upon approval of the work site preparation by consultant or delegated authority, contractor may proceed to remove the material using the below listed procedures.
4. Put down polyethylene drop cloth below removal area to catch any debris generated during removal.
5. Place tools, equipment and materials needed in work area.
6. Spray amended water ACM prior to start of removal.
7. Do not cut, abrade, or break ACM.
8. Do not allow ACM to drop from elevated heights. Always carry disposal bag to the ground, do not drop.
9. If material can cut through the disposal bags, place ACM into one 6 mil bag and then into barrels for fiber drums.
10. Clean up any debris or dust using HEPA vacuuming and wet wiping.
11. Notify consultant or delegated authority that work is complete so that a visual inspection and any clearance air monitoring can be conducted.
12. Upon passage of the visual inspection and clearance air monitoring (if conducted), warning signs, barrier tape, and critical barriers may be removed.

4.9.3 For Miscellaneous Friable Materials

The following procedures shall be used to remove friable ACM:

1. Isolate or shut down, lock-out and tag-out HVAC system (and other building systems that may create a hazard during the removal activity) in compliance with all local, state, and federal regulations and as specified in the Specification/Work Plan.

2. Regulate and isolate the work area with warning signs, barrier tape, and critical barriers in compliance with all local, state, and federal regulations called out in the Specification/Work Plan.
3. Set up a negative pressure enclosure around the work area in compliance with all local, state, and federal regulations and as specified in the Specification/Work Plan.
4. Construct hygiene facilities with an equipment room; shower area; clean change room; lunch areas; decontamination of workers, equipment and containers in compliance with all local, state, and federal regulations and as specified in this Specification/Work Plan.
5. Upon approval of the work site preparation by consultant or delegated authority, contractor may proceed to remove the material using the below listed procedures.
6. Place tools, equipment and materials needed into enclosure.
7. HEPA vacuum the work area.
8. Thoroughly wet the asbestos-containing material to be removed to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water. Saturate material sufficiently to wet to the substrate without causing excess dripping. Allow time for water to penetrate material thoroughly. Spray material repeatedly with amended water during the work process to maintain a continuously wet condition.
9. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels using commercially available "foggers."
10. Remove saturated asbestos-containing material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash down station adjacent to material decontamination unit.
11. Pick up any debris and place into disposal bags. HEPA vacuum and wet wipe any dust generated.
12. Use nylon brushes and wet rags to clean any residual asbestos-containing material from the area. Lightly mist with a lock-down encapsulant the area where the material was removed and 6inches to 12 inches around the area. This will lock down any fibers which may have settled onto the vicinity adjacent to the work area. The HEPA vacuum should be continuously running during the final cleaning and encapsulating work.
13. Notify consultant or delegated authority that work is complete so that a visual inspection and any clearance air monitoring can be conducted.
14. Upon passage of the visual inspection and clearance air monitoring (if conducted), warning signs, barrier tape, mini-containment and critical barriers may be removed.
15. Attach appropriate asbestos warning labels to the outside of the second layer of wrapping and properly dispose of material as friable ACM waste.

5.0 REINSPECTION PROGRAM

A reinspection program is an integral part of the O&M program. Periodic surveillance of all ACM in DESE facilities is conducted every six months. Friable materials are re-inspected by certified Asbestos Inspectors every three years. The condition of ACM is recorded and based upon the assessment; the appropriate response actions are undertaken.

Each homogenous area of friable surfacing ACM, thermal system ACM, and miscellaneous ACM should be categorized in one of the following Asbestos Hazard Emergency Response Act (AHERA) assessment categories:

1) Damaged or significantly damaged thermal system insulation
2) Damaged friable surfacing ACM
3) Significantly damaged friable surfacing ACM
4) Damaged or significantly damaged friable miscellaneous ACM
5) ACM with potential for damage
6) ACM with potential for significant damage
7) Any remaining friable ACM or friable suspected ACM

During all periodic surveillance and reinspections, the inspector should advise DESE of any changes in condition or potential problem areas.

6.0 RECORDKEEPING

All asbestos related records must be retained to comply with all Federal, State, and Local regulations. Records that are required to be maintained include, but are not limited to, the following:

- Employee training records for one year beyond the last date of each worker's employment.
- Inspection, reinspection, and assessment reports of all buildings surveyed indefinitely.
- Asbestos related employee medical records for duration of employment plus 30 years.
- OSHA personnel air sampling records for 30 years.
- A copy of this O&M program.
- All disposal documentation for a minimum of 30 years, but recommended to be kept indefinitely.

7.0 EMERGENCY PROCEDURES

If a release or suspected release of asbestos fibers occurs, evacuate the area of concern and call:

Ron Littich at 573-751-8296

Clean up of asbestos spills must be performed by specially trained personnel. Proper procedures must be followed to reduce the spread of asbestos fibers after a release has occurred. Depending on the severity of the release, an asbestos contractor may need to be called to conduct the cleanup operation.

8.0 CERTIFICATION OF REPORT

The information contained in this report has been generated by OCCU-TEC Inc.

If there are any questions as to condition of ACM in select locations throughout the facility, quantities of original identified ACM remaining in the facility, or identification of non-friable ACM, a thorough reinspection by an accredited Asbestos Inspector should be conducted.

This operations and maintenance program has been developed by Mr. Jay Hurst of OCCU-TEC Inc. If questions arise concerning this operations and maintenance plan, please call OCCU-TEC Inc. at (816) 231-5580.

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Jay Hurst
Missouri Certified Asbestos Inspector / Management Planner

SCI ENGINEERING, INC.
EARTH • SCIENCE • SOLUTIONS
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

June 22, 2022

Haley Coons, P.E., S.E.
Oates Associates
720 Olive, Suite 700
St. Louis, Missouri 63101

RE: Limited Lead-Based Paint Survey Report
Missouri School for the Blind
St. Louis, Missouri
SCI No. 2015-0067.27

Dear Haley Coons:

INTRODUCTION

SCI Engineering, Inc. (SCI) is pleased to submit this report summarizing limited lead-based paint (LBP) survey activities performed on June 6, 2022. SCI understands that the project includes the repair of the swimming pool located in the basement Pool Room. The purpose of this survey was to determine the presence of lead-based paint within the portions of the basement which will be impacted by renovation activities.

LEAD BASED PAINT SURVEY

X-Ray Fluorescence Testing (XRF)

This survey was performed using an XRF that can quickly and nondestructively determine the quantity of lead present in paint coatings on various interior and exterior components of the structures. The limited lead survey activities were performed by Daniel Vielweber, a Missouri-Licensed Lead Inspector. A copy of Daniel Vielweber's lead license is included in Appendix D.

The United States Department of Housing and Urban Development and the Missouri Department of Natural Resources indicates that LBP is any paint, varnish, stain, or other applied coating that has one milligram per square centimeter (mg/cm^2) or 5,000 micrograms per gram (ug/g) by dry weight (0.5 percent by mass) or more of lead. Based upon a review of the XRF results, several of the paint systems analyzed had a lead content greater than 1.0 mg/cm^3. A summary of these LPB systems is included in Table 1 below. Enclosed in Appendix A is a complete summary of the lead testing results. Enclosed in Appendix B are field sketches showing the test locations. Appendix C includes photographic documentation of the lead-based paint coatings identified during this survey.

Table 1 - LBP XRF Results

Sample Number	Sample Location	Sample Description
11	Basement, Pump Room – Side A	Red concrete steps
70	Basement, Girls Locker Room 3 – Side B	Gray ceramic wall tile
71	Basement, Girls Locker Room 3 – Side D	Gray ceramic wall tile

CONCLUSION

As can be seen in Table 1 above, several paint coatings were identified as being LBP coatings. These materials include the red paint on the concrete steps in the basement pump room and the gray ceramic wall tile in the girls' locker room.

During renovation of these areas, care should be taken not to sand, grind or abrade surfaces coated with LBPs. Any disturbance of these painted surfaces must be performed by workers that are renovation, repair and paint program (RRP) trained. If the painted building components are to remain and be refinished, then stripping the paint should be performed by a licensed abatement contractor. If the components are to be removed, then they can be removed by RRP-trained workers with appropriate safety training and disposed as construction waste. There are no special disposal considerations in Missouri for disposal of demolition rubble from this structure as long as it is disposed in a licensed solid waste landfill.

We appreciate the opportunity to be of service to you on this project. If you have any questions or comments regarding these results, please feel free to contact us.

Respectfully,

SCI ENGINEERING, INC.

Daniel P. Vielweber
Field Scientist

Jessica B. Keeven, CHMM
Senior Scientist

DPV/JBK/rah

Enclosures
Appendix A - XRF Results
Appendix B - Field Sketches
Appendix C - Photographic Documentation
Appendix D - Lead License

APPENDIX 2

Appendix A

XRF Results
Missouri School for the Blind
SCI No. 2015-0067.27

Reading No	Date/Time	Floor	Room	Side	Color	Substrate	Component	Comments	Results
	6/6/2022 10:27	Calibration							Negative
	6/6/2022 10:28	Calibration							Positive
1	6/6/2022 10:31	Basement	Pump room	A	Gray	Metal	Door	sliding door	Negative
2	6/6/2022 10:32	Basement	Pump room	A	Black	Metal	Door	Entry door	Negative
3	6/6/2022 10:32	Basement	Pump room	A	Blue	Metal	Door Jamb	Entry door	Negative
4	6/6/2022 10:34	Basement	Pump room	A	Blue	Wood	Door Casing	Entry door	Negative
5	6/6/2022 10:35	Basement	Pump room	A	White	Wood	Door Casing	Entry door	Negative
6	6/6/2022 10:35	Basement	Pump room	A	White	Concrete	Wall		Negative
7	6/6/2022 10:37	Basement	Pump room	C	White	Concrete	Wall		Negative
8	6/6/2022 10:38	Basement	Pump room	--	Blue	Metal	Stand		Negative
9	6/6/2022 10:38	Basement	Pump room	D	White	Wood	Window Frame		Negative
10	6/6/2022 10:40	Basement	Pump room	D	Black	Metal	Stand		Negative
11	6/6/2022 10:41	Basement	Pump room	A	Red	Concrete	Steps	Entry Steps	Positive
12	6/6/2022 10:43	Basement	Pool	A	Tan	Ceramic Tile	Wall		Negative
13	6/6/2022 10:43	Basement	Pool	A	Brown	Ceramic Tile	Wall		Negative
14	6/6/2022 10:44	Basement	Pool	--	Tan/Brown	Ceramic Tile	Floor		Negative
15	6/6/2022 10:45	Basement	Pool	--	Black	Ceramic Tile	Floor		Negative
16	6/6/2022 10:46	Basement	Pool	--	Tan	Ceramic Tile	Floor		Negative
17	6/6/2022 10:47	Basement	Pool	--	Brown	Ceramic Tile	Floor		Negative
18	6/6/2022 10:48	Basement	Pool	A	White	Ceramic Tile	Wall		Negative
19	6/6/2022 10:49	Basement	Pool	A	Black	Metal	Door		Negative
20	6/6/2022 10:49	Basement	Pool	A	Black	Metal	Door Jamb		Negative
21	6/6/2022 10:50	Basement	Pool	B	Brown	Wood	Door		Negative
22	6/6/2022 10:51	Basement	Pool	B	Black	Wood	Door Jamb		Negative
23	6/6/2022 10:51	Basement	Pool	C	Tan	CMU	Wall		Negative
24	6/6/2022 10:52	Basement	Pool	B	Green	Ceramic	Water Fountain		Negative
25	6/6/2022 10:54	Basement	Pool	C	Tan	PVC	Pipe		Negative
26	6/6/2022 10:55	Basement	Pool	C	Tan	Ceramic Tile	Wall		Negative
27	6/6/2022 10:55	Basement	Pool	C	Brown	Ceramic Tile	Wall		Negative
28	6/6/2022 10:56	Basement	Pool	C	Black	PVC	Pipe		Negative
29	6/6/2022 10:58	Basement	Pool	B	White	Ceramic Tile	Pool Wall	1x1 Pool Tile	Negative

XRF Results
Missouri School for the Blind
SCI No. 2015-0067.27

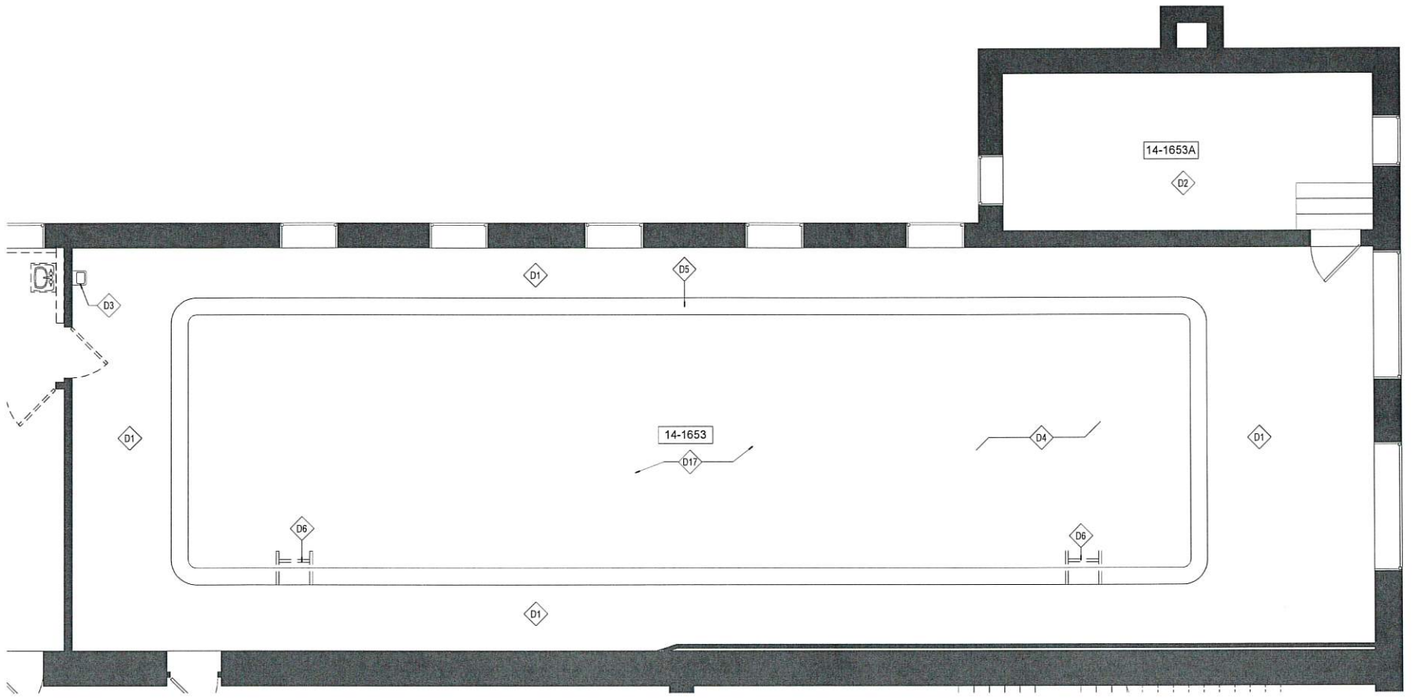
Reading No	Date/Time	Floor	Room	Side	Color	Substrate	Component	Comments	Results
30	6/6/2022 10:59	Basement	Pool	B	Yellow	Ceramic Tile	Pool Wall	1x1 Pool Tile	Negative
31	6/6/2022 10:59	Basement	Pool	--	Black	Ceramic Tile	Pool Floor	1x1 Pool Tile	Negative
32	6/6/2022 11:00	Basement	Pool	C	White	Ceramic Tile	Pool Wall	1x1 Pool Tile	Negative
33	6/6/2022 11:02	Basement	Pool	--	White	Plastic	Pool Floor	Pool Drain	Negative
34	6/6/2022 11:03	Basement	Pool	A	Green	Metal	Pool Ladder		Negative
35	6/6/2022 11:11	Basement	Boys Locker Room 2	C	Yellow	Ceramic Tile	Wall		Negative
36	6/6/2022 11:11	Basement	BLR 2	C	Green	Ceramic Tile	Wall		Negative
37	6/6/2022 11:13	Basement	BLR 2	--	White	Plaster	Ceiling		Negative
38	6/6/2022 11:13	Basement	BLR 2	--	Red	Metal	Pipe		Negative
39	6/6/2022 11:13	Basement	BLR 2	--	White	Metal	Pipe		Negative
40	6/6/2022 11:15	Basement	BLR 2	--	Gray	Wood	Steps		Negative
41	6/6/2022 11:15	Basement	BLR 2	A	White	Wood	Bench		Negative
42	6/6/2022 11:16	Basement	BLR 2	D	White	Metal	Vent		Negative
43	6/6/2022 11:17	Basement	BLR 1	A	White	Plaster	Wall		Negative
44	6/6/2022 11:17	Basement	BLR 1	D	White	Plaster	Wall		Negative
45	6/6/2022 11:18	Basement	BLR 1	--	White	Metal	HVAC		Negative
46	6/6/2022 11:18	Basement	BLR 1	C	Tan	Ceramic	Window Sill		Negative
47	6/6/2022 11:19	Basement	BLR 1	A	Brown	Wood	Door		Negative
48	6/6/2022 11:19	Basement	BLR 1	A	Black	Metal	Door Jamb		Negative
49	6/6/2022 11:20	Basement	BLR 1	B	Beige	Metal	Bath Stall		Negative
50	6/6/2022 11:21	Basement	BLR 2	--	Brown	Ceramic Tile	Floor		Negative
51	6/6/2022 11:22	Basement	BLR 4	C	Black	Wood	Window Frame		Negative
52	6/6/2022 11:22	Basement	BLR 4	C	Black	Wood	Window Sill		Negative
53	6/6/2022 11:23	Basement	BLR 4	C	Gray	Metal	Lockers		Negative
54	6/6/2022 11:24	Basement	BLR 4	--	Gray	Concrete	Floor		Negative
55	6/6/2022 11:24	Basement	BLR 5	C	White	Concrete	Wall		Negative
56	6/6/2022 11:26	Basement	BLR 5	C	White	Wood	Window Frame		Negative
57	6/6/2022 11:26	Basement	BLR 5	C	White	Wood	Window Sill		Negative
58	6/6/2022 11:26	Basement	BLR 5	A	Black	Wood	Door		Negative
59	6/6/2022 11:27	Basement	BLR 5	A	Black	Wood	Door Jamb		Negative
60	6/6/2022 11:30	Basement	BLR 6	B	Black	Wood	Door		Negative

XRF Results
Missouri School for the Blind
SCI No. 2015-0067.27

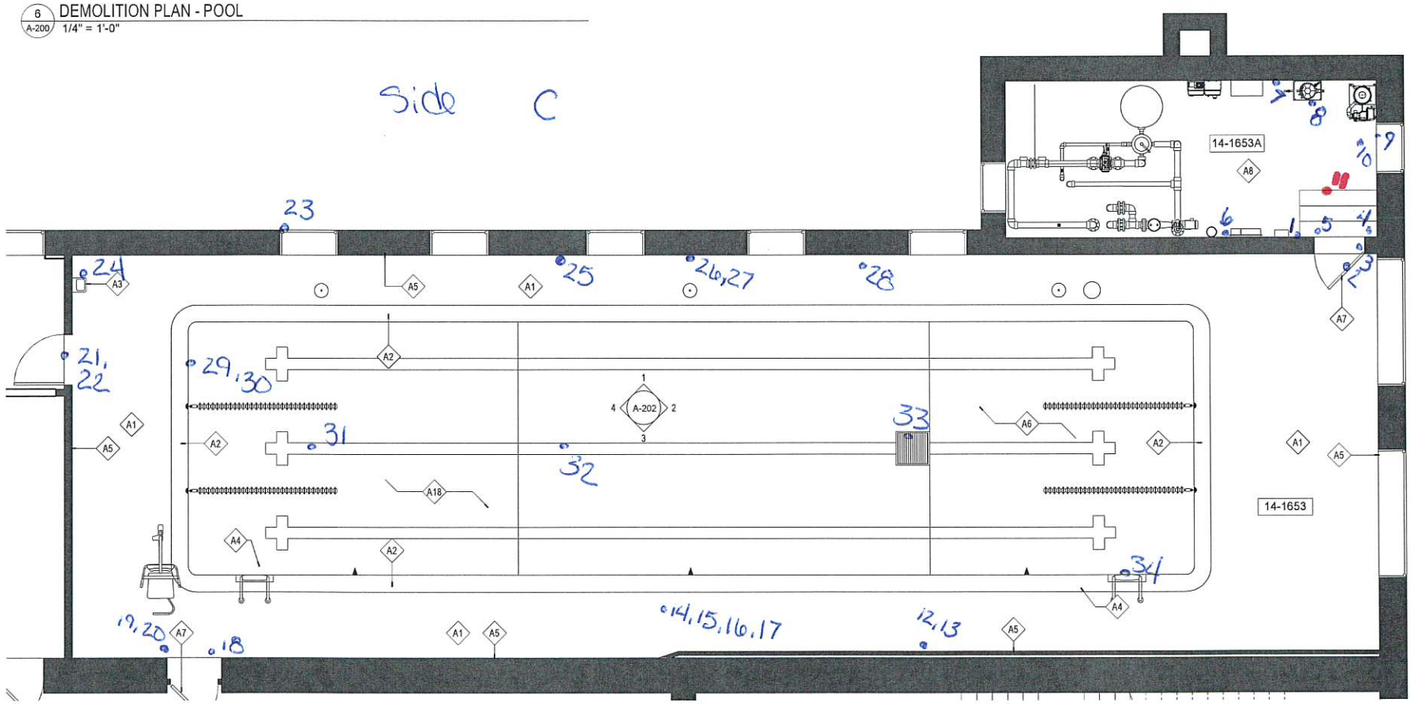
Reading No	Date/Time	Floor	Room	Side	Color	Substrate	Component	Comments	Results
61	6/6/2022 11:31	Basement	BLR 6	B	Black	Wood	Door Jamb		Negative
62	6/6/2022 11:31	Basement	BLR 6	C	White	Plaster	Wall		Negative
63	6/6/2022 11:33	Basement	BLR 4	A	Brown	Ceramic	Covebase		Negative
64	6/6/2022 11:45	Basement	Girls Locker Room 1	B	White	Concrete	Wall		Negative
65	6/6/2022 11:46	Basement	GLR 1	D	Black	Wood	Door Jamb		Negative
66	6/6/2022 11:47	Basement	GLR 1	D	Black	Metal	Door		Negative
67	6/6/2022 11:48	Basement	GLR 2	--	Tan	Ceramic Tile	Floor		Negative
68	6/6/2022 11:48	Basement	GLR 2	--	White	Plaster	Ceiling		Negative
69	6/6/2022 11:49	Basement	GLR 2	--	Red	Metal	Pipe		Negative
70	6/6/2022 11:49	Basement	GLR 3	B	Gray	Ceramic Tile	Wall	Shower wall tile	Positive
71	6/6/2022 11:51	Basement	GLR 3	D	Gray	Ceramic Tile	Wall	Shower wall tile	Positive
72	6/6/2022 11:52	Basement	GLR 3	C	Blue	Ceramic Tile	Wall		Negative
73	6/6/2022 11:53	Basement	GLR 3	--	White	Metal	Pipe		Negative
74	6/6/2022 11:54	Basement	GLR 4	D	White	Concrete	Wall		Negative
75	6/6/2022 11:55	Basement	GLR 4	D	White	Wood	Shelf		Negative
76	6/6/2022 11:55	Basement	GLR 4	A	White	Brick	Wall		Negative
77	6/6/2022 11:56	Basement	GLR 4	B	White	Metal	Pipe		Negative
78	6/6/2022 11:57	Basement	GLR 4	A	Tan	Ceramic Tile	Window Sill		Negative
79	6/6/2022 11:58	Basement	GLR 5	A	White	Drywall	Wall		Negative
80	6/6/2022 11:59	Basement	GLR 5	A	Black	Metal	Lockers		Negative
81	6/6/2022 11:59	Basement	GLR 5	C	Tan	Ceramic	Covebase		Negative
82	6/6/2022 12:00	Basement	GLR 5	A	White	Brick	Wall		Negative
83	6/6/2022 12:01	Basement	GLR 2	C	Black	Metal	Door		Negative
84	6/6/2022 12:01	Basement	GLR 2	C	Black	Metal	Door Jamb		Negative
85	6/6/2022 12:02	Basement	GLR 2	D	White	Plaster	Wall		Negative
	6/6/2022 12:14	Calibration							Negative
	6/6/2022 12:14	Calibration							Positive

Appendix B

LBP Sample Locations



6 A-200 DEMOLITION PLAN - POOL
1/4" = 1'-0"



21 A-200 FLOOR PLAN - POOL
1/4" = 1'-0"

GENERAL NOTES: DEMOLITION

1. PROVIDE TEMPORARY BARRICADES AND OTHER FORMS OF PROTECTION AS REQUIRED TO PROTECT OWNER'S AND CLIENT'S PERSONNEL AND GENERAL PUBLIC FROM INJURY DUE TO SELECTIVE DEMOLITION WORK.
2. ERECT AND MAINTAIN DUST-PROOF PARTITIONS AND CLOSURES AS REQUIRED TO PREVENT SPREAD OF DUST OR FUMES TO OCCUPIED PORTIONS OF THE BUILDING. PROTECT MECHANICAL SYSTEM AS REQUIRED.
3. CONDUCT SELECTIVE DEMOLITION OPERATIONS AND DEBRIS REMOVAL IN A MANNER TO ENSURE MINIMUM INTERFERENCE WITH ROADS, STREETS, WALKS, AND OTHER ADJACENT OCCUPIED OR USED FACILITIES.
4. PROVIDE BYPASS CONNECTIONS AS NECESSARY TO MAINTAIN CONTINUITY OF SERVICE TO OCCUPIED AREAS OF THE BUILDING.
5. REVIEW/COORDINATE SCHEDULE OF WORK TO BE DEMOLISHED WITH BUILDING MANAGEMENT TO LIMIT INTERRUPTIONS OF OWNER-OCCUPIED SPACES.
6. MAINTAIN FIRE PROTECTION SERVICES DURING SELECTIVE DEMOLITION.
7. COVER AND PROTECT EQUIPMENT AND FIXTURES INDICATED "TO REMAIN" FROM SOILAGE OR DAMAGE.
8. LOCATE, IDENTIFY, STUB OFF, AND DISCONNECT UTILITY SERVICES THAT ARE NOT INDICATED TO REMAIN.
9. PERFORM SELECTIVE DEMOLITION WORK IN A SYSTEMATIC MANNER.
10. UNO ALL EXISTING PARTITIONS, FIRE EXTINGUISHERS AND CABINETS, MILLWORK, DOORS, HARDWARE, SIDELITES, CLERESTORIES, ETC. TO REMAIN.
11. REMOVE ALL HEADERS AT DOOR LOCATIONS WHERE DOORS ARE INDICATED TO BE REMOVED.
12. WHERE WALLS OR PARTITIONS ARE TO BE REMOVED, REMOVE OR RELOCATE ALL EXISTING ELECTRICAL WIRING, DATA CABLING, TELEPHONE LINES, CABLE LINES, SATELLITE LINES, CONDUIT, WIRE MOLD, RECEPTACLES AND SWITCH BOXES, ETC. LOCATED WITHIN DEMOLISHED PORTIONS.
13. SALVAGE AND STORE ALL DOORS AND SIDELITES FOR POSSIBLE REUSE. OWNER HAS FIRST RIGHT OF REFUSAL ON ALL REMOVED ITEMS AND CONTRACTOR IS RESPONSIBLE FOR DISPOSAL IF OWNER DOES NOT WANT ITEMS.
14. PATCH ALL PENETRATIONS FROM MEP DEMO (CONDUIT, PIPING, ETC. REMOVAL) TO MATCH EXISTING ADJACENT CONSTRUCTION.
15. SEE PLUMBING DRAWINGS FOR FLOOR DRAIN LOCATIONS.

DEMOLITION NOTES: POOL

1. REMOVE & STORE PORTABLE LIFT.
2. REMOVE & ABANDON EXISTING DIVING STAND SUPPORT.
3. REMOVE & SALVAGE POOL LADDERS.

ARCH/FINISH NOTES: POOL

1. INSTALL DECK ANCHOR AND KIT FOR FIXED LIFT TO COMPLY WITH ADA REGULATIONS.
2. ADD NEW DEPTH MARKINGS AND WARNING SIGNS AT POOL DECK.
3. CLEAN TILE GROUT AND PATCH REPAIR AS REQUIRED.
4. EXISTING ACT CEILING AND LIGHTING TO REMAIN.
5. CEILING & LIGHTING NOT INCLUDED IN PROJECT SCOPE. COORDINATE WITH WORK PERFORMED UNDER SEPERATE SCOPE

D# KEYED NOTES - DEMOLITION

D1	BASE BID: DEMO / REMOVE POOL DECK & SUBSTRUCTURE TO PERIMETER WALLS. REMOVE PERIMETER WALL TILE BASE FINISH AS REQUIRED TO REMOVE & REPLACE POOL DECK.
D2	BASE BID: DEMO / REMOVE EXISTING POOL EQUIPMENT. SEE ENGINEERING DWGS
D3	BASE BID: DEMO / REMOVE WATER FOUNTAIN
D4	BASE BID: TRENCH POOL FLOOR TO PROVIDE ACCESS TO PIPING SYSTEMS - WORK NOTED ON STURCTURAL, MEP AND POOL DOCUMENTS.
D5	BASE BID: DEMO / REMOVE EXISTING POOL GUTTER & DECK DRAINING
D6	BASE BID: DEMO / REMOVE EXISTING LADDER & ACCESSORIES
D17	ALTERNATE 1: REMOVE ALL TILE WITHIN POOL VOLUME (BOTTOM AND SIDES)

A# KEYED NOTES - ARCHITECTURAL

A1	BASE BID: NEW CONCRETE POOL DECK W/BRUSHED FINISH INSTALL SEALER. SLOPE TO NEW DECK DRAINS. SEE STRUCTURAL DRAWINGS
A2	BASE BID: NEW COPING W/INWALL SKIMMERS. SEE ENGINEERING DWGS
A3	BASE BID: NEW WATER FOUNTAIN W/BOTTLE FILLER. ELKAY #EZS8WSLIC OR EQUAL.
A4	BASE BID: NEW POOL LADDER & ACCESSORIES. SEE ENGINEERING DRAWINGS.
A5	BASE BID: NEW COVE TLE BASE. EXISTING WALL TILE TO REMAIN
A6	BASE BID: NEW CONCRETE SLAB INFILL PER STRUCTURAL. INSTALL NEW TIL-6 AT BOTTOM AND SIDES, TIL-5 AT LANE MARKERS.
A7	BASE BID: PAINT EXISTING DOOR & FRAME
A8	BASE BID: NEW POOL EQUIMENT, SEE ENGINEERING DWGS.
A18	ALTERNATE 1: PROVIDE NEW TILE. ENTIRE POOL VOLUME (BOTTOM AND SIDES). TIL-6 (FIELD), TIL-5 (LANE MARKERS)

• denotes negative test location
• denotes positive test location

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STATE OF MISSOURI
MICHAEL L. PARSON, GOVERNOR

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OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

DEPARTMENT OF ELEMENTARY & SECONDARY EDUCATION

REPAIR SWIMMING POOL

MISSOURI SCHOOL FOR THE BLIND
3815 MAGNOLIA AVENUE
ST. LOUIS, MO

PROJECT # E2107-01
SITE# 2011
FACILITY # 5012011003, 501201104

REVISION:
DATE:
REVISION:
DATE:
REVISION:
DATE:
ISSUE DATE: 03/22/22

CAD DWG FILE: A-200
DRAWN BY: Author
CHECKED BY: Checker
DESIGNED BY: Designer

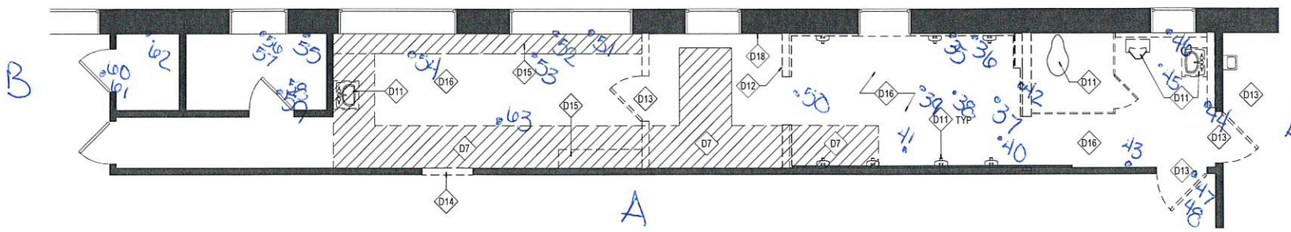
SHEET TITLE:

ENLARGED PLANS - POOL

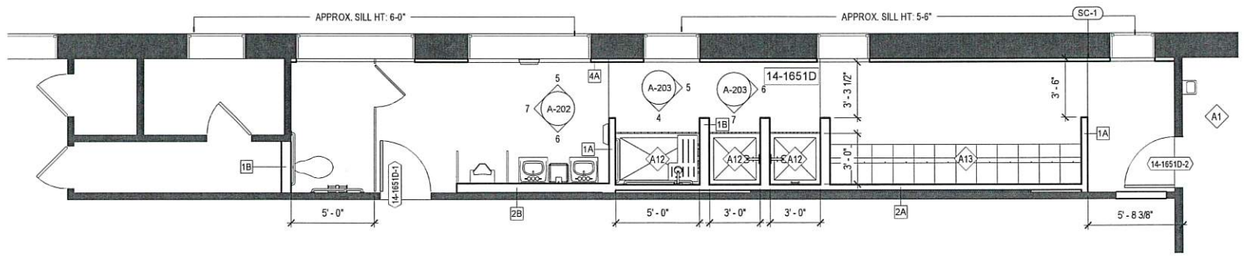
SHEET NUMBER:

A-200

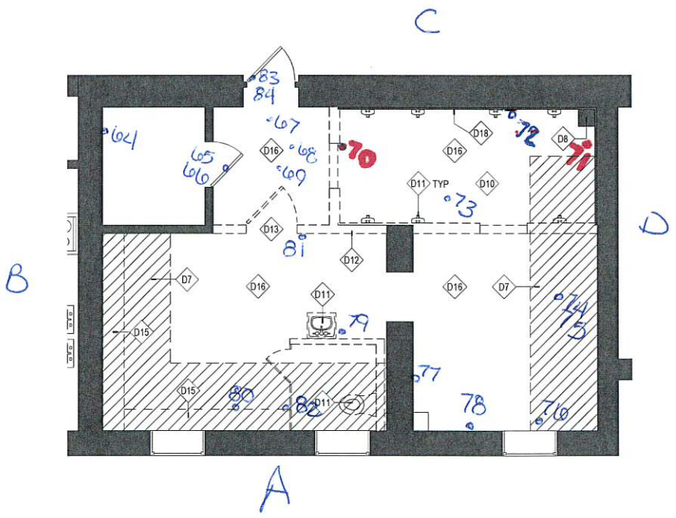
8 OF 45 SHEETS
03/22/22



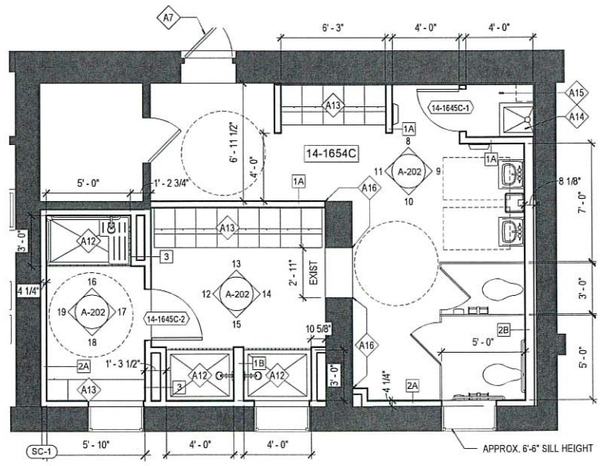
1 A-201 DEMOLITION PLAN - BOYS' LOCKER ROOM - ALTERNATE 3
1/4" = 1'-0"



6 A-201 FLOOR PLAN - BOYS' LOCKER ROOM - ALTERNATE 3
1/4" = 1'-0"



21 A-201 DEMOLITION PLAN - GIRLS' LOCKER ROOM - ALTERNATE 3
1/4" = 1'-0"



23 A-201 FLOOR PLAN - GIRLS' LOCKER ROOM - ALTERNATE 3
1/4" = 1'-0"

GENERAL NOTES: DEMOLITION

1. PROVIDE TEMPORARY BARRICADES AND OTHER FORMS OF PROTECTION AS REQUIRED TO PROTECT OWNER'S AND CLIENT'S PERSONNEL AND GENERAL PUBLIC FROM INJURY DUE TO SELECTIVE DEMOLITION WORK.
2. ERECT AND MAINTAIN DUST-PROOF PARTITIONS AND CLOSURES AS REQUIRED TO PREVENT SPREAD OF DUST OR FUMES TO OCCUPIED PORTIONS OF THE BUILDING, PROTECT MECHANICAL SYSTEM AS REQUIRED.
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4. PROVIDE BYPASS CONNECTIONS AS NECESSARY TO MAINTAIN CONTINUITY OF SERVICE TO OCCUPIED AREAS OF THE BUILDING.
5. REVIEW/COORDINATE SCHEDULE OF WORK TO BE DEMOLISHED WITH BUILDING MANAGEMENT TO LIMIT INTERRUPTIONS OF OWNER-OCCUPIED SPACES.
6. MAINTAIN FIRE PROTECTION SERVICES DURING SELECTIVE DEMOLITION.
7. COVER AND PROTECT EQUIPMENT AND FIXTURES INDICATED "TO REMAIN" FROM SOILAGE OR DAMAGE.
8. LOCATE, IDENTIFY, STUB OFF, AND DISCONNECT UTILITY SERVICES THAT ARE NOT INDICATED TO REMAIN.
9. PERFORM SELECTIVE DEMOLITION WORK IN A SYSTEMATIC MANNER.
10. UNO ALL EXISTING PARTITIONS, FIRE EXTINGUISHERS AND CABINETS, MILLWORK, DOORS, HARDWARE, SIDELITES, CLERESTORIES, ETC, TO REMAIN.
11. REMOVE ALL HEADERS AT DOOR LOCATIONS WHERE DOORS ARE INDICATED TO BE REMOVED.
12. WHERE WALLS OR PARTITIONS ARE TO BE REMOVED, REMOVE OR RELOCATE ALL EXISTING ELECTRICAL WIRING, DATA CABLING, TELEPHONE LINES, CABLE LINES, SATELLITE LINES, CONDUIT, WIRE MOLD, RECEPTACLES AND SWITCH BOXES, ETC. LOCATED WITHIN DEMOLISHED PORTIONS.
13. SALVAGE AND STORE ALL DOORS AND SIDELITES FOR POSSIBLE REUSE. OWNER HAS FIRST RIGHT OF REFUSAL ON ALL REMOVED ITEMS AND CONTRACTOR IS RESPONSIBLE FOR DISPOSAL IF OWNER DOES NOT WANT ITEMS.
14. PATCH ALL PENETRATIONS FROM MEP DEMO (CONDUIT, PIPING, ETC. REMOVAL) TO MATCH EXISTING ADJACENT CONSTRUCTION.
15. SEE PLUMBING DRAWINGS FOR FLOOR DRAIN LOCATIONS.

D# KEYED NOTES - DEMOLITION

D3	BASE BID: DEMO / REMOVE WATER FOUNTAIN
D6	BASE BID: DEMO / REMOVE EXISTING LADDER & ACCESSORIES
D7	DEMO / REMOVE PORTION OF CONCRETE SLAB / TRENCH FLOOR AS REQUIRED FOR NEW UNDERGROUND PLUMBING
D8	EXISTING SPRINKLER CLEANOUT
D10	DEMO / REMOVE EXISTING WALL TILE THROUGHOUT
D11	DEMO / REMOVE EXISING PLUMBING FIXTURES AND TOILET ACCESSORIES, TYP.
D12	DEMO / REMOVE EXISTING PARTITIONS AS INDICATED, TYP.
D13	DEMO / REMOVE EXISTING DOOR & FRAME
D14	DEMO PORTION OF EXISTING WALL TO PROVIDE FOR NEW OPENING
D15	REMOVE EXISTING LOCKERS & CONC. SUPPORT PLATFORM (WHERE OCCURS), TYP.
D16	REMOVE EXISTING FLOOR FINISH THROUGHOUT
D18	DEMO/REMOVE EXISTING WALL FURRING/TILE/FINISH. PREP TO RECEIVE SELECTED FINISH. SKIMCOAT PLASTER AT LOCATIONS TO BE PAINTED.

GENERAL NOTES: LOCKER ROOMS

1. BACKFILL TRENCH TRENCH AND INSTALL NEW REINFORCED CONCRETE SLAB TO MATCH EXIST ADJACENT CONSCTRUCTION. DOWEL NEW CONCRETE INTO EXIST. INSTALL VPAOR BARRIER UNDER NEW CONCRETE.
2. PROVIDE NEW METAL STUD FRAMED GYP BD PARTITIONS AS SHOWN.
3. NEW WALLS TO RECEIVE CERAMIC TILE.
4. PROVIDE EPOXY FLOOR WITH INTEGRAL BASE THROUGHOUT.
5. PROVIDE NEW PREFINISHED METAL TOILET PARTITIONS.
6. PAINT EXISTING WALLS WITH EPOXY PAINT.
7. PROVIDE WALL MOUNTED MIRROR ABOVE SINK.
8. PROVIDE HAND DRYER AT EACH LOCKER ROOM.
9. NEW DOORS & FRAMES TO BE HOLLOW METAL, PAINTED.

A# KEYED NOTES - ARCHITECTURAL

A1	BASE BID: NEW CONCRETE POOL DECK W/BRUSHED FINISH INSTALL SEALER. SLOPE TO NEW DECK DRAINS. SEE STRUCTURAL DRAWINGS
A7	BASE BID: PAINT EXISTING DOOR & FRAME
A12	FIBERGLASS SHOWER UNIT, BENCH AND GRAB BARS AT ACCESSIBLE UNIT
A13	NEW LOCKER W/BENCH
A14	FLOOR MOUNTED MOP SINK
A15	INSTALLED FRP PANELS ALL WALLS FROM FLOOR TO 60"
A16	PREP EXISTING WALL TO RECEIVE SCHEDULED FINISH

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REPAIR SWIMMING POOL

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3815 MAGNOLIA AVENUE
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PROJECT #	E2107-01
SITE#	2011
FACILITY #	5012011003, 501201104

REVISION:
DATE:
REVISION:
DATE:
REVISION:
DATE:
ISSUE DATE: 03/22/22

CAD DWG FILE: A-201
DRAWN BY: Author
CHECKED BY: Checker
DESIGNED BY: Designer

SHEET TITLE:

ENLARGED PLANS - LOCKER RMS

SHEET NUMBER:

A-201

9 OF 45 SHEETS
03/22/22

Appendix C

Photo 1. Red concrete steps in the pump room (11).

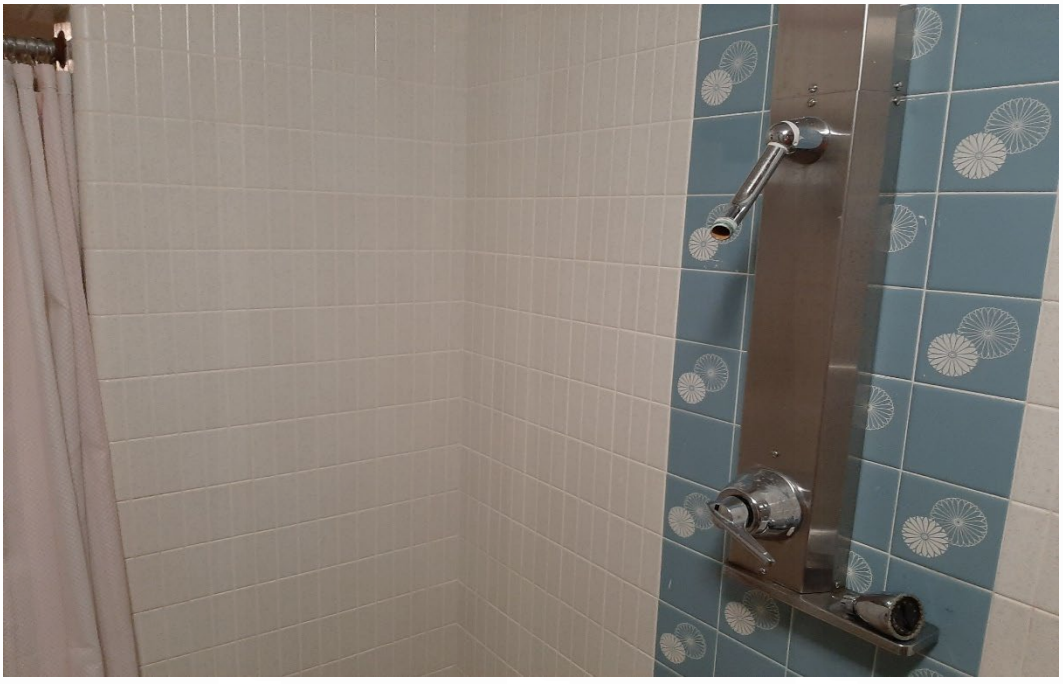

Photo 2. Gray ceramic wall tile in the girls' locker room (70 & 71).

Appendix D

Missouri Department of Health and Senior Services

Lead Occupation License - ID Badge

License Number: 190128-300005680

Lead Inspector

Daniel

Vielweber

Expiration Date: 1/28/2023